

NUCLEAR SCIENCE ABSTRACTS

Vol. 7, No. 23, December 15, 1953

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CALENDAR OF MEETINGS

Suggestions for additions to this list will be welcomed and should be sent with all pertinent information to the Cataloging Branch, Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

March 15-19, 1954

ELEVATED TEMPERATURE CORROSION SYMPOSIUM, Municipal Auditorium, Kansas City, Mo. Sponsored by: National Association of Corrosion Engineers - 10th Annual Conference

Person to Contact: Glenn A. Fitzlen
Ass't. Technical Director
Haynes Stellite Co.
Kokomo, Ind.

June 20-25, 1954

NUCLEAR ENERGY CONFERENCE, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineers, Ann Arbor, Michigan.

ERRATA

Vol. 7, No. 13. In abstract 3683, p. 449, and in Reports Reference List, p. v, report NP-4560 should be changed to NYO-4451.

Vol. 7, No. 13. In abstract 3684, p. 449, and in Reports Reference List, p. v, report NP-4561 should be changed to NYO-4456.

Vol. 7, No. 13. In abstract 3685, p. 449, and in Reports Reference List, p. v, report NP-4562 should be changed to NYO-4557.

Vol. 7, No. 13. In abstract 3686, p. 449, and in Reports Reference List, p. v, report NP-4563 should be changed to NYO-4452.

REPORTS REFERENCE LIST

Vol. 7, No. 23

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

USAEC DECLASSIFIED REPORTS

AECD-3478

6599

Radiation Lab., Univ. of Calif., Berkeley
VARIATION OF NEUTRON TOTAL CROSS SECTION OF BISMUTH AND URANIUM BETWEEN 45 AND 160 MEV (thesis). William I. Linlor. July 30, 1953, declassified Oct. 2, 1953. 94p. (AECD-3478; UCRL-2303)

AECD-3535

6428

Carbide and Carbon Chemicals Co. (Y-12)
THE DETERMINATION OF ADSORBED MOISTURE ON URANIUM AND URANIUM OXIDE; A NEW METHOD FOR MOISTURE DETERMINATIONS. James O. Hibbits and Donald Zucker. Apr. 22, 1953. Decl. June 17, 1953. 18p. (AECD-3535; Y-959)

AECD-3541

6499

Westinghouse Atomic Power Div.
THERMOCOUPLES OF TANTALUM, TUNGSTEN, AND MOLYBDENUM. R. K. McGearry. Aug. 18, 1952. Decl. June 19, 1953. 11p. (AECD-3541; WAPD-58)

AECD-3544

6472

Ames Lab.
THE NIOBIUM-THORIUM ALLOY SYSTEM. J. M. Dickinson, O. N. Carlson, and H. A. Wilhelm. Aug. 13, 1953. Decl. without deletions Oct. 19, 1953. 13p. (AECD-3544; ISC-391)

AECD-3547

6637

Los Alamos Scientific Lab.
THE ENERGY DISTRIBUTION OF SLOWED FISSION FRAGMENTS. J. A. Northrop and J. E. Brolley, Jr. [nd] Decl. Sept. 8, 1953. 3p. (AECD-3547)

AECD-3548

6555

Los Alamos Scientific Lab.
ON THE DETECTION OF THE FREE NEUTRINO. F. Reines and C. L. Cowan, Jr. Aug. 6, 1953. Decl. Aug. 24, 1953. 7p. (AECD-3548)

AECD-3551

6619

Los Alamos Scientific Lab.
THE FRACTION OF THE MASS 141 CHAIN FORMED INDEPENDENTLY AS La^{141} IN THE THERMAL NEUTRON FISSION OF U^{235} . G. P. Ford and C. W. Stanley. Decl. Aug. 20, 1953. 9p. (AECD-3551)

AECD-3554

6425

Los Alamos Scientific Lab.
PREPARATION, IDENTIFICATION, AND CRYSTAL STRUCTURE OF A PENTAVALENT AMERICIUM COMPOUND, KAmO_2F_2 . L. B. Asprey, F. H. Ellinger, and W. H. Zachariasen. Decl. Aug. 5, 1953. 12p. (AECD-3554)

AECD-3555

6362

Radiation Lab., Univ. of Calif., Berkeley
CHEMISTRY DIVISION QUARTERLY REPORT [FOR]

MARCH, APRIL, MAY 1953. June 25, 1953. Decl. Aug. 25, 1953. 76p. (AECD-3555; UCRL-2257)

AECD-3558

6500

Los Alamos Scientific Lab.
SEPARATION OF A SHOCK WAVE INTO ELASTIC AND PLASTIC WAVES, AND MEASUREMENT OF THE PRESSURE OF THE ELASTIC WAVE. [With Addendum] Stanley Minshall. Decl. June 17, 1953. [Presented] July 1-3, 1953. 24p. (AECD-3558)

AECD-3560

6473

Battelle Memorial Inst.
THORIUM-CARBON ALLOYS. R. M. Goldhoff, H. R. Ogden, and R. I. Jaffee. June 19, 1953. Decl. Sept. 9, 1953. 52p. (AECD-3560; BMI-844)

AECD-3577

6363

Battelle Memorial Inst.
THE SURFACE REACTION BETWEEN OXYGEN AND THORIUM. A. F. Gerds and M. W. Mallett. May 26, 1953. Decl. Aug. 5, 1953. 20p. (AECD-3577; BMI-830)

AECD-3578

6364

Battelle Memorial Inst.
THE REACTION OF NITROGEN WITH THORIUM AND THE DIFFUSION OF NITROGEN IN THORIUM. A. F. Gerds and M. W. Mallett. May 26, 1953. Decl. Aug. 5, 1953. 22p. (AECD-3578; BMI-831)

AECD-3579

6429

Carbide and Carbon Chemicals Co. (Y-12)
FURTHER INVESTIGATION OF XERORADIOGRAPHY FOR RADIOGRAPHIC INSPECTION OF URANIUM. R. E. Cofield. Feb. 1, 1953. Decl. Aug. 21, 1953. 16p. (AECD-3579; Y-979)

AECD-3581

6430

Mound Lab.
THE SURFACE TENSION OF AQUEOUS URANYL SULFATE SOLUTIONS BETWEEN 20° AND 75°C. M. K. Barnett and J. Jegart. Feb. 15, 1953. Decl. Sept. 8, 1953. 10p. (AECD-3581; MLM-815)

AECD-3586

6474

Battelle Memorial Inst.
THE PREPARATION OF HIGH-PURITY THORIUM BY THE IODIDE PROCESS. N. D. Veigel, E. M. Sherwood, and I. E. Campbell. Jan. 2, 1953. Decl. June 30, 1953. 16p. (AECD-3586; BMI-777)

AECD-3589

6635

Radiation Lab., Univ. of Calif., Berkeley
CAVITY DESIGN DATA FOR HIGH ENERGY LINEAR ACCELERATORS. S. W. Kitchen, A. D. Schelberg, B. V. Hill, and R. G. Smits. Dec. 9, 1952. Decl. Sept. 9, 1953. 47p. (AECD-3589; UCRL-2046)

- AECD-3590 6615
Oak Ridge National Lab.
RECALIBRATION OF THE X-10 STANDARD GRAPHITE
PILE. E. D. Klema, R. H. Ritchie, and G. McCammon.
Issued Oct. 17, 1952. Decl. Aug. 6, 1953. 9p. (AECD-
3590; ORNL-1398)
- USAEC UNCLASSIFIED REPORTS**
- AECU-2373 6620
Los Alamos Scientific Lab.
CROSS SECTIONS FOR THE $O^{16}(n,p)N^{16}$ REACTION FROM
12 TO 18 MEV. H. C. Martin. [1953] 6p. (AECU-2373)
- AECU-2461 6400
Kedzie Chemical Lab., Michigan State Coll.
THE PHYSICAL PROPERTIES OF HALOGEN FLUORIDES.
DIELECTRIC CONSTANTS OF LIQUID CHLORINE TRI-
FLUORIDE AND IODINE PENTAFLUORIDE. H. Bradford
Thompson, John L. Speirs, and Max T. Rogers. [1953?] 4p. (AECU-2461)
- AECU-2616 6501
Laboratory for Nuclear Science, Mass. Inst. of Tech.
ANNUAL PROGRESS REPORT [FOR PERIOD MAY 31,
1952 TO] MAY 31, 1953. May 31, 1953. 217p. (AECU-
2616)
- AECU-2616(p.1-80) 6502
Laboratory for Nuclear Science, Mass. Inst. of Tech.
CHEMISTRY OF THE FISSION ELEMENTS GROUP;
COSMIC RAY GROUP; AND ELEMENTARY PARTICLE
SCATTERING GROUP. D. N. Hume, L. B. Rogers,
B. Rossi, R. W. Williams, H. S. Bridge, and J. R. Zacharias.
p.1-80 of ANNUAL PROGRESS REPORT [FOR PERIOD
MAY 31, 1952 TO] MAY 31, 1953. 80p. (AECU-2616(p.1-
80))
- AECU-2616(p.81-112) 6503
Laboratory for Nuclear Science, Mass. Inst. of Tech.
NUCLEAR CHEMISTRY (INORGANIC) GROUP AND
NUCLEAR CHEMISTRY (ORGANIC) GROUP. C. D. Coryell,
J. W. Irvine, Jr., and J. D. Roberts. p.81-112 of ANNUAL
PROGRESS REPORT [FOR PERIOD MAY 31, 1952 TO]
MAY 31, 1953. 32p. (AECU-2616(p.81-112))
- AECU-2616(p.113-58) 6504
Laboratory for Nuclear Science, Mass. Inst. of Tech.
ONR GENERATOR GROUP, AND RADIOACTIVITY AND
CYCLOTRON GROUP. W. W. Buechner, R. D. Evans, and
M. S. Livingston. p.113-58 of ANNUAL REPORT [FOR
PERIOD MAY 31, 1952 TO] MAY 31, 1953. 47p.
(AECU-2616(p.113-58))
- AECU-2616(p.159-83) 6505
Laboratory for Nuclear Science, Mass. Inst. of Tech.
SYNCHROTRON GROUP AND THEORETICAL GROUP.
L. S. Osborne and V. F. Weisskopf. p.159-83 of ANNUAL
REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953.
26p. (AECU-2616(p.159-83))
- AECU-2633 6348
Los Alamos Scientific Lab.
DETERMINATION OF SYSTEMICALLY DEPOSITED
PLUTONIUM IN LABORATORY PERSONNEL AND A
SIMPLE QUALITATIVE TEST FOR EXPOSURE TO AIR-
BORNE RADIOACTIVE MATERIAL. Louis H. Hempelmann
and Wright H. Langham. Los Alamos Scientific Lab. and
Rochester Univ. School of Medicine. [1953] 14p.
(AECU-2633)
- AECU-2639 6417
Knolls Atomic Power Lab.
THE "PUMP-MIX" MIXER SETTLER. A NEW LIQUID-
LIQUID EXTRACTOR. B. V. Coplan, J. K. Davidson, and
E. L. Zebroski. [1953] 26p. (AECU-2639)
- AECU-2650 6622
Los Alamos Scientific Lab.
EXCITATION FUNCTIONS FOR THE $(n,2n)$ REACTIONS
IN Ge, Sc, As, Tl, and Ni. S. J. Bame, Jr. [1953?] 5p.
(AECU-2650)
- AECU-2651 6587
Los Alamos Scientific Lab.
FURTHER RESULTS ON MONTE CARLO EQUATIONS
OF STATE. Marshall N. Rosenbluth and Arianna W.
Rosenbluth. [1953?] 13p. (AECU-2651)
- AECU-2652 6357
Harvard Univ.
PROGRESS REPORT. Jan. 1, 1953. 33p. (AECU-2652)
- AECU-2655 6638
Los Alamos Scientific Lab.
INELASTIC SCATTERING OF PROTONS AND NEUTRONS
BY DEUTERONS. R. M. Frank and J. L. Gammel. [1953?] 28p. (AECU-2655)
- AECU-2662 6323
Worcester Foundation for Experimental Biology
HYDROCORTISONE IN NORMAL GUINEA PIG URINE:
ISOLATION AND QUANTITATIVE DETERMINATION.
Shlomo Burstein and Ralph I. Dorfman. [1953] 15p.
(AECU-2662)
- AECU-2663 6467
Wisconsin Univ.
NEW METHODS FOR URANIUM EXPLORATION AND
RECOVERY FROM LOW GRADE ORES. RESEARCH
PROGRESS REPORT, JANUARY 1, 1952 TO JANUARY 1,
1953. 24p. (AECU-2663)
- AECU-2664 6658
Purdue Research Foundation
PRODUCTION OF LATTICE DEFECTS IN GERMANIUM BY
ELECTRON BOMBARDMENT. Everett Earl Klontz. June
1952. 84p. (AECU-2664)
- AECU-2666 6639
Los Alamos Scientific Lab.
CROSS SECTIONS FOR PRODUCTION OF In^{115m} , AND
 Au^{197m} BY INELASTIC SCATTERING OF NEUTRONS.
H. C. Martin, B. C. Diven, and R. F. Taschek. [1953] 23p. (AECU-2666)
- AECU-2667 6475
Commonwealth Engineering Co. of Ohio
GAS PLATED COATINGS ON METALS AND ALLOYS.
PROGRESS REPORT. June 10, 1953. 12p. (AECU-2667;
Progress Report 4)
- AECU-2668 6640
Los Alamos Scientific Lab.
ELASTIC SCATTERING OF FAST NEUTRONS BY He.
John D. Seagrave. [1953?] 28p. (AECU-2668)
- AECU-2669 6365
Los Alamos Scientific Lab.
REACTION OF THALLIUM WITH OXYGEN AND MOIS-
TURE. J. T. Waber and G. E. Sturdy. [1953?] 16p.
(AECU-2669)
- AECU-2671 6441
Los Alamos Scientific Lab.
ACTIVATED SLUDGE TREATMENT OF A MIXTURE OF
RADIOACTIVE LAUNDRY WASTE AND SANITARY
SEWAGE. Leo M. Reading, Everett R. Mathews, C. W.
Christenson, and J. F. Newell. [1953?] 11p. (AECU-2671)
- AECU-2677 6358
Anesthesia Lab., Harvard Medical School
BRAIN POTASSIUM EXCHANGE IN NORMAL ADULT AND

- IMMATURE RATS (thesis). Robert Katzman and P. Herbert Leiderman, Anesthesia Lab., Harvard Medical School and Biophysical Lab., Harvard Medical School. [1953] 30p. (AECU-2677)
- AECU-2678 6573**
New York Univ.
FINAL STATUS REPORT. I. ON THE POSITIVE EXCESS OF COSMIC RAY μ -MESONS. II. RADIATIVE BOHR ORBIT TRANSITIONS OF STOPPED NEGATIVE μ -MESONS. III. FUTURE RESEARCH. APP. A AND B. H. A. Morewitz, M. H. Shamos, and A. Fafarman. May 31, 1953. 41p. (AECU-2678)
- AECU-2681 6422**
New York Univ. Coll. of Medicine
THE BIOSYNTHESIS OF NUCLEIC ACIDS IN THE LIVERS OF ADULT MICE. Jacques R. Fresco, New York University College of Medicine and Alfred Marshak, United States Public Health Service. [nd] 30p. (AECU-2681)
- AECU-2683 6423**
Worcester Foundation for Experimental Biology
THE METABOLISM OF PREGNANE-17 α ,21-DIOL-3,20-DIONE AND PREGNANE-17 α ,21-DIOL-3,11,20-TRIONE IN VIVO. Frank Ungar, John W. Davis, Harris Rosenkrantz, and Ralph I. Dorfman. Worcester Foundation for Experimental Biology and Boston Univ. [1953] 20p. (AECU-2683)
- AECU-2685 6659**
Washington Univ., St. Louis
RADIOACTIVE CHARGING THROUGH SOLID DIELECTRICS. Paul Y. H. Feng and J. W. Kennedy. [1953] 3p. (AECU-2685)
- AECU-2687 6623**
Los Alamos Scientific Lab.
CROSS SECTIONS FOR THE REACTIONS D(d,p)T, D(d,n)He³, T(d,n)He⁴, AND He³(d,p)He⁴ BELOW 120 KEV. W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. [1953?] 40p. (AECU-2687)
- AECU-2689 6359**
Anesthesia Lab., Harvard Medical School
EFFECT OF ADRENALECTOMY, DESOXYCORTICOSTERONE, AND CORTISONE ON DRAIN-POTASSIUM EXCHANGE (thesis). P. Herbert Leiderman and Robert Katzman, Anesthesia Lab., Harvard Medical School and Biophysical Lab., Harvard Medical School. [1953] 23p. (AECU-2689)
- AECU-2693 6366**
Los Alamos Scientific Lab.
KINETICS OF THE ALKALINE DECOMPOSITION OF 1,3-DINITRO-1,3-DIAZACYCLOPENTANE. Walter H. Jones. [1953] 6p. (AECU-2693)
- AECU-2694 6551**
Los Alamos Scientific Lab.
ON THE ASYMPTOTIC INTEGRATION OF INTEGRAL EQUATIONS. George F. Carrier. [1953] 9p. (AECU-2694)
- AECU-2695 6327**
Tennessee Univ. Coll. of Agriculture
THE EFFECTS OF IRRADIATION FROM ATOMIC BOMB FALL-OUT UPON A GROUP OF HEREFORD CATTLE (THESIS). James Merrill Bird. Mar. 1952. 78p. (AECU-2695)
- AECU-2697 6328**
New England Deaconess Hospital, Boston
EFFECTS OF IONIZING RADIATIONS (AND OTHER AGENTS) ON THE DEVELOPING MAMMAL. Samuel P. Hicks, New England Deaconess Hospital, Boston and Harvard Medical School and Pondville Hospital, Walpole, Mass. [1953] 6p. (AECU-2697)
- AECU-2700 6431**
Los Alamos Scientific Lab.
A NEW FORM OF URANIUM HYDRIDE. R. N. R. Mulford, F. H. Ellinger, and W. H. Zachariasen. [1953] 5p. (AECU-2700)
- AECU-2743 6621**
Research Foundation, Ohio State Univ.
RESONANCE CAPTURE OF PROTONS BY Mg²⁵. Warren E. Taylor, Leonard N. Russell, and John N. Cooper. [1953?] 12p. (AECU-2743)
- ANL-4928 6585**
Argonne National Lab.
SUMMARY OF METEOROLOGICAL DATA TAKEN AT ARGONNE NATIONAL LABORATORY, DU PAGE COUNTY, ILLINOIS, JULY 1951 THROUGH JUNE 1952. Feb. 1953. 121p. (ANL-4928)
- ANL-5116 6367**
Argonne National Lab.
THE STRUCTURE OF THE PERRHENATE ION. Howard H. Claassen and A. J. Zielen. Sept. 8, 1953. 8p. (ANL-5116)
- BMI-858 6442**
Battelle Memorial Inst.
EMPIRICAL EVALUATION OF THE PROPERTIES OF STEAM AT ELEVATED TEMPERATURES AND PRESSURES. A. W. Lemmon, Jr., D. J. Daniels, D. E. Sparrow, C. J. Geankoplis, J. J. Ward, and J. W. Clegg. Aug. 25, 1953. 64p. (BMI-858)
- BNL-246 6322**
Brookhaven National Lab.
ANNUAL REPORT; JULY 1, 1953. 144p. (BNL-246)
- BNL-1539 6418**
Sterling Chemistry Lab., Yale Univ.
ADSORPTION STUDIES ON CLAY MINERALS. 4. THE SYSTEM MONTMORILLONITE-CESIUM-POTASSIUM. Joseph A. Faucher and Henry C. Thomas. [1953] 17p. (BNL-1539)
- BNL-1542 6600**
Brookhaven National Lab.
FORMATION OF THE LONG-LIVED Bi²¹⁰ ISOMER. D. J. Hughes and H. Palevsky. [1953] 22p. (BNL-1542)
- BNL-1552 6574**
Brookhaven National Lab.
A THEOREM ON PHOTO-MESON PRODUCTION NEAR THRESHOLD AND THE SUPPRESSION OF PAIRS IN PSEUDOSCALAR MESON THEORY. Norman M. Kroll and Malvin A. Ruderman. [Summer 1953] 22p. (BNL-1552)
- COO-197 6660**
Illinois Univ.
PROGRESS REPORT NO. 4 [ON RADIATION DAMAGE AND RECOVERY IN Cu, Ag, Au, Ni, AND Ta]. J. S. Koehler. Aug. 1, 1953. 8p. (COO-197; Progress Report 4)
- HW-28268 6616**
Hanford Works
DISTRIBUTION OF THERMAL NEUTRONS IN EXPONENTIAL AND SIGMA PILES. G. E. Duvall. June 3, 1953. 16p. (HW-28268)
- HW-28636 6330**
Hanford Works
BIOLOGY RESEARCH. ANNUAL REPORT, 1952. July 7, 1953. 189p. (HW-28636)
- HW-28636(p.8-97) 6331**
Hanford Works
[PAGES 8-97 OF] ANNUAL REPORT [ON] BIOLOGY

- RESEARCH [FOR] 1952. July 7, 1953. 90p. (HW-28636(p.8-97))
- HW-28636(p.98-185) **6332**
Hanford Works
[PAGES 98-185 OF] ANNUAL REPORT [ON] BIOLOGY RESEARCH [FOR] 1952. July 7, 1953. 88p. (HW-28636(p.98-185))
- ISC-228 **6479**
Ames Lab.
THE TITANIUM-VANADIUM SYSTEM. R. M. Powers and H. A. Wilhelm. September 1952. 174p. (ISC-228)
- ISC-409 **6533**
Ames Lab.
A SIMPLE LINE-OPERATED CONSTANT CURRENT SUPPLY. David E. Winkel and Harry J. Svec. Sept. 18, 1953. 10p. (ISC-409)
- K-1031 **6456**
Carbide and Carbon Chemicals Co. (K-25)
MODIFIED HOKE CONNECTOR. E. C. Evans and A. Langdon. Issued Sept. 22, 1953. 8p. (K-1031)
- KAPL-955 **6480**
Knolls Atomic Power Lab.
THE TITANIUM-HYDROGEN SYSTEM. R. M. Haag and F. J. Shipko. July 1, 1953. 42p. (KAPL-955)
- KAPL-972 **6375**
Knolls Atomic Power Lab.
DETERMINATION OF SODIUM MONOXIDE IN SODIUM. AN ADDENDUM. L. P. Pepkowitz, W. C. Judd, and R. J. Downer. Aug. 5, 1953. 9p. (KAPL-972)
- LA-1583 **6642**
Los Alamos Scientific Lab.
A MONTE CARLO DETERMINATION OF THE ESCAPE FRACTION FOR A SCATTERING SPHERICAL SHELL WITH CENTRAL POINT SOURCE. C. J. Everett, E. D. Cashwell, and O. W. Rechard. Aug. 24, 1953. 11p. (LA-1583)
- LRL-58 **6481**
Livermore Research Lab., Calif. Research and Development Co.
ENDURANCE LIMIT OF CRYSTAL BAR ZIRCONIUM. W. P. Wallace and R. H. Wallace. Issued Sept. 1953. 12p. (LRL-58)
- MLM-850 **6457**
Mound Lab.
A LARGE-DIAMETER RECIPROCATING-ACTION VACUUM VALVE. George L. Fox. May 22, 1953. 7p. (MLM-850)
- NYO-996 **6552***
Forrestal Research Center, Princeton Univ.
ON THE AMOUNT OF VARIATION OF THE SOLUTION OF A DIFFERENCE EQUATION. [PROJECT MATTERHORN] Martin Kruskal. Oct. 2, 1951. 8p. (NYO-996; PM-S-3(app.))
- NYO-3548 **6372**
Cornell Univ.
THE CHEMISTRY OF THE HETEROPOLY ACIDS (thesis). C. E. Erickson. Jan. 1951. 36p. (NYO-3548)
- NYO-3594 **6663**
Laboratory for Nuclear Science, Mass. Inst. of Tech.
 β -DECAY THEORY FOR CHEMISTS. Donald R. Wiles. [1953] 14p. (NYO-3594)
- NYO-3822 **6508**
Massachusetts Inst. of Tech.
SHORTING AND FIELD CORRECTIONS IN HALL MEAS- UREMENTS. W. F. Flanagan, P. A. Flinn, and B. L. Averbach. Aug. 1953. 13p. (NYO-3822)
- NYO-3841 **6541**
Rochester Univ.
A NEW NEUTRON-DEFICIENT ISOTOPE OF KRYPTON. Albert A. Caretto, Jr. and Edwin O. Wiig. Sept. 21, 1953. 4p. (NYO-3841)
- NYO-6138 **6559**
Columbia Univ.
ON THE LOADING OF ELECTRON SENSITIVE NUCLEAR EMULSION. S. Goldhaber, J. C. Bielk, E. M. Frankl, and Gerson Goldhaber. Aug. 1953. 34p. (NYO-6138; CU-14-53-AEC-1019-Chem.)
- RME-3053 **6378**
Armour Research Foundation
A STUDY OF RADIOMETRIC TECHNIQUES FOR EVALUATING THE URANIUM CONTENT OF ROCKS AND MINERALS. FINAL REPORT. C. A. Stone and L. Reiffel. Issued June 1953. 28p. (RME-3053)
- SO-3254 **6409**
Rensselaer Polytechnic Inst.
DECOMPOSITION OF CARBON DIOXIDE BY IONIZING RADIATION. SEMIANNUAL REPORT. S. Dondes and A. J. Hogan. July 1, 1953. 30p. (SO-3254)
- TID-3041 **6432**
Technical Information Service, AEC
URANIUM AND ITS COMPOUNDS: A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Robert E. Allen, Comp. June 30, 1953. (TID-3041)
- TID-3050(pt.1) **6461**
Technical Information Service, AEC
A BIBLIOGRAPHY OF SELECTED AEC REPORTS OF INTEREST TO INDUSTRY. PART 1. METALLURGY AND CERAMICS. Oct. 1953. 38p. (TID-3050(pt.1))
- UCLA-268 **6324**
Atomic Energy Project, Univ. of Calif., Los Angeles
A DETERMINATION OF THE RATE OF DEVELOPMENT OF ACUTE PULMONARY EDEMA. B. Cassen and K. Kistler. Submitted Oct. 15, 1953. 8p. (UCLA-268)
- UCRL-2328 **6624**
Radiation Lab., Univ. of Calif., Berkeley
RANGE DISTRIBUTION OF ALPHA PARTICLES FOLLOWING THE DECAYS OF Li^8 AND B^8 . F. C. Gilbert. Aug. 28, 1953. 6p. (UCRL-2328)
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Radiation Lab., Univ. of Calif., Berkeley
PASSAGE OF ELECTRONS THROUGH MATTER. Edward Vaughan. Sept. 9, 1953. 12p. (UCRL-2338)
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- AD-766 **6511**
Georgia Inst. of Tech. State Engineering Experiment Station
INVESTIGATION OF AGGREGATION OF FINE PARTICLE MATTER SUSPENDED IN AIR. J. M. Dallavalle, Clyde Orr, Jr., and B. L. Hinkle. Dec. 14, 1952. 30p. (AD-766; Quarterly Report 6)
- AD-3380 **6512**
Polytechnic Inst. of Brooklyn
THEORETICAL INVESTIGATION OF THE GROWTH OF AEROSOL PARTICLES BY DIFFUSION. H. L. Frisch and F. C. Collins. [1951] 18p. (AD-3380; Report 1)

- AD-10067 6399
Cryogenic Lab., Ohio State Univ.
HEAT CAPACITIES, LATENT HEATS AND ENTROPIES OF FLUORINE FROM 13° TO 85° K; HEATS OF TRANSITION, FUSION, VAPORIZATION AND VAPOR PRESSURES OF THE LIQUID. Jih-Heng Hu, David White, and Herrick L. Johnston. Apr. 20, 1953. 21p. (AD-10067; TR-283-23)
- AERE-GP/R-1228 6532
Atomic Energy Research Establishment, Harwell, Berks (England)
DEVELOPMENTS IN THE MAGNETRON AMPLIFIER. J. Dain. Aug. 1953. 8p. (AERE-GP/R-1228)
- AERE-N/M-11D 6592*
Atomic Energy Research Establishment, Harwell, Berks (England)
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Atomic Energy Research Establishment, Harwell, Berks (England)
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- AMRL-119 6329
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HISTOPATHOLOGY OF THE RAT PITUITARY FOLLOWING TOTAL BODY X-IRRADIATION. Roy Korson and Albert L. Botkin. July 9, 1953. 11p. (AMRL-119)
- ATI-76656 6462*
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THE PREPARATION OF LABORATORY WARE IN BERYLLIA BY SLIP CASTING. A. R. Edwards and F. Henderson. Nov. 1948. 13p. (ATI-76656; Structures and Materials Note 174)
- ATI-166644 6476
Battelle Memorial Inst.
ALLOYS FOR HIGH-TEMPERATURE SERVICE (INVESTIGATION OF THE FUNDAMENTAL FACTORS PROMOTING HIGH-TEMPERATURE STRENGTH OF ALLOYS). SUMMARY REPORT. R. L. Beck, E. E. Fletcher, A. R. Elsea, A. B. Westerman, and G. K. Manning. Mar. 31, 1952. 74p. (ATI-166644; U-22514)
- CAL-44 6445*
Cornell Aeronautical Lab., Inc.
THREE-DIMENSIONAL LIQUID ANALOG FOR THE DETERMINATION OF TEMPERATURE DISTRIBUTION. (PROJECT SQUID). G. A. Sterbutzel and J. L. Beal. Oct. 1952. 40p. (CAL-44)
- CM-758 6408*
Naval Research Lab., Univ. of Wis.
SURVEY OF THE EQUATION OF STATE AND TRANSPORT PROPERTIES OF GASES AND LIQUIDS. R. B. Bird, J. O. Hirschfelder and C. F. Curtiss. Nov. 15, 1952. 73p. (CM-758; AD-5522)
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California Research and Development Co., Livermore
DYNAMIC CORROSION OF STEEL BY LIQUID BISMUTH. O. J. Elgert and C. J. Egan. Aug. 29, 1952. 18p. (CRD-T1-74)
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Columbia Radiation Lab., Columbia Univ.
QUARTERLY PROGRESS REPORT, [APRIL THRU JUNE, 1953]. June 30, 1953. 44p. (CU-2-53-SC-42519-Phys; Quarterly Progress Report 2)
- CU-20-53-AF-75-Met 6478
Columbia Univ. School of Mines
A FUNDAMENTAL STUDY IN THE PRINCIPLES GOVERNING SEIZING AND GALLING IN METALS. QUARTERLY PROGRESS REPORT, MAY 6, 1953 TO AUGUST 6, 1953. E. S. Machlin and W. R. Yankee. [1953] 5p. (CU-20-53-AF-75-Met)
- GS-C-279 6468
Geological Survey
RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE RUBY-POORMAN AND NIXON FORK DISTRICTS, WEST-CENTRAL ALASKA, 1949. Max G. White and John M. Stevens. [1953] 22p. (GS-C-279)
- MR-518 6376
Pitman-Dunn Labs., Frankford Arsenal
COLORIMETRIC DETERMINATION OF SMALL AMOUNTS OF BORON IN TITANIUM ALLOYS. M. Codell and G. Norwitz. Aug. 1952. 18p. (MR-518; ATI-168254)
- MR-549 6377
Pitman-Dunn Labs., Frankford Arsenal
COLORIMETRIC DETERMINATION OF CHROMIUM IN TITANIUM ALLOYS. G. Norwitz and M. Codell. Apr. 1953. 15p. (MR-549; AD-9590)
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METHODS FOR DETERMINATION AND COMPUTATION OF FLOW PATTERNS OF A COMPRESSIBLE FLUID. Stefan Bergman, Brown Univ. and Langley Memorial Aeronautical Lab., NACA. Sept. 1946. 80p. (NACA-TN-1018)
- NACA-TN-2988 6447
Lewis Flight Propulsion Lab., NACA
TEMPERATURES, THERMAL STRESS, AND SHOCK IN HEAT-GENERATING PLATES OF CONSTANT CONDUCTIVITY AND OF CONDUCTIVITY THAT VARIES LINEARLY WITH TEMPERATURE. S. V. Manson. July 1953. 62p. (NACA-TN-2988)
- NACA-TN-2994 6443
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COLUMN STRENGTH OF H-SECTIONS AND SQUARE TUBES IN POSTBUCKLING RANGE OF COMPONENT PLATES. P. P. Bijlaard and G. O. Fisher. Aug. 1953. 106p. (NACA-TN-2994)
- NACA-TN-3011 6466
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COEFFICIENT OF FRICTION AND DAMAGE TO CONTACT AREA DURING THE EARLY STAGES OF FRETTING. 1. GLASS, COPPER, OR STEEL AGAINST COPPER. Douglas Godfrey and John M. Bailey. Sept. 1953. 23p. (NACA-TN-3011)
- NACA-TN-3016 6448
Lewis Flight Propulsion Lab., NACA
ANALYSIS OF TURBULENT HEAT TRANSFER AND FLOW IN THE ENTRANCE REGIONS OF SMOOTH PASSAGES. Robert G. Deissler. Oct. 1953. 88p. (NACA-TN-3016)
- NACA-TN-3017 6454
Langley Aeronautical Lab., NACA
AXIAL-LOAD FATIGUE TESTS ON NOTCHED AND UNNOTCHED SHEET SPECIMENS OF 61S-T6 ALUMINUM ALLOY, ANNEALED 347 STAINLESS STEEL, AND HEAT-TREATED 403 STAINLESS STEEL. Herbert F. Hardrath, Charles B. Landers, and Elmer C. Utley, Jr. Oct. 1953. 28p. (NACA-TN-3017)
- NBS-2626 6396
National Bureau of Standards
A CRITICAL REVIEW OF THE LITERATURE RELATING

TO THE VAPOR PRESSURE OF AMMONIA AND TRI-DEUTEROAMMONIA. George T. Armstrong. June 30, 1953. 38p. (NBS-2626)

NBS-2768

6643

National Bureau of Standards
THE ALBEDO OF VARIOUS MATERIALS FOR 1 MEV PHOTONS. Evans Hayward and John H. Hubbell. Sept. 11, 1953. 26p. (NBS-2768)

NBS-2799

6534

Office of Basic Instrumentation, National Bureau of Standards
ABSOLUTE MEASUREMENT OF VIBRATION AMPLITUDES. Walter Koidan. Sept. 1953. 34p. (NBS-2799)

NBS-2817

6556

National Bureau of Standards
CALIBRATION OF LANDSVERK 0.2-r MODEL 80 MIDGET FINGER CHAMBERS WHEN USED WITH LANDSVERK MODEL L-62 CHARGER-READER. F. H. Day. Sept. 25, 1953. 22p. (NBS-2817)

NP-4730

6394

Cryogenic Lab., Ohio State Univ.
FORMATION, STABILITY AND CRYSTAL STRUCTURE OF SOLID SILICON MONOXIDE. Michael Hoch and Herrick L. Johnston. Feb. 27, 1953. 15p. (NP-4730; AD-994; TR-280-7)

NP-4760

6368

Wisconsin Univ.
THE PREPARATION AND PROPERTIES OF ZIRCONIUM AND HAFNIUM CHELATES OF CERTAIN β -DIKETONES. Edwin M. Larsen, Glenn Terry, and James Leddy. Aug. 3, 1953. 20p. (NP-4760; Technical Report 5)

NP-4765

6482

Institute of Engineering Research, Univ. of Calif., Berkeley
CORRELATIONS OF RUPTURE DATA FOR METALS AT ELEVATED TEMPERATURES. Raymond L. Orr, Oleg D. Sherby, and John E. Dorn. July 1, 1953. 36p. (NP-4765; Technical Report 27)

NP-4767

6369

University of Southern Calif.
ENERGY TRANSFER PROCESSES IN REACTION KINETICS; TECHNICAL REPORT [FOR] PERIOD JUNE 19, 1952-JUNE 18, 1953. Sidney W. Benson, Arthur E. Axworthy, Jr., Charles Cousin, and Gerald B. Porter. July 15, 1953. 118p. (NP-4767; Technical Report 1)

NP-4772

6420

Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 18. VIBRATIONAL SPECTRA OF $C^{13}H_3I$; TECHNICAL REPORT [ON] MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Richard B. Bernstein, Forrest F. Cleveland, and Fred L. Voelz. Aug. 14, 1953. 18p. (NP-4772; Technical Report 16)

NP-4773

6671

Spectroscopy Lab., Ill. Inst. of Tech.
SUBSTITUTED METHANES. 19. C^{13} ISOTOPIC SHIFTS IN THE VIBRATIONAL SPECTRUM OF METHANOL; TECHNICAL REPORT [ON] MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Richard B. Bernstein, James E. Lamport, and Forrest F. Cleveland. Submitted Aug. 14, 1953. 3p. (NP-4773; Technical Report 17)

NP-4779

6401

Maine Univ.
INVESTIGATE PHYSICAL AND PHYSICO-CHEMICAL PROPERTIES OF MIXTURES OF HYDROCARBONS AND FLUOROCARBONS. QUARTERLY PROGRESS REPORT,

OCTOBER 1, 1952-JANUARY 2, 1953. Robert D. Dunlap. Feb. 3, 1953. 7p. (NP-4779; AD-6749; Quarterly Progress Report 4)

NP-4784

6483

Magnesium Labs., Dow Chemical Co.
THE EFFECT OF TEMPERATURE ON THE LATTICE DIMENSIONS OF MAGNESIUM AND MAGNESIUM ALLOYS. Sept. 14, 1950. (NP-4784; Quarterly Status Report 1)

NP-4785

6484

Magnesium Labs., Dow Chemical Co.
FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT PROPERTIES OF MAGNESIUM. Dec. 11, 1950. 12p. (NP-4785; Quarterly Status Report 2)

NP-4788

6485

Metallurgical Labs., Dow Chemical Co.
FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT THE PROPERTIES OF MAGNESIUM. June 18, 1952. 6p. (NP-4788; Quarterly Status Report 6)

NP-4790

6535

Research Foundation, Okla. Agricultural and Mechanical Coll.
A HIGH TEMPERATURE RADIATION CALORIMETER. FINAL REPORT. Irving Johnson. Aug. 31, 1953. 30p. (NP-4790)

NP-4802

6449

Sverdrup and Parcel, Inc.
THE CONTACT THERMAL RESISTANCE OFFERED BY THE WELDED JUNCTIONS BETWEEN A ROUND DUCT AND ITS ENCIRCLING STIFFENING WEBS. Carl A. Moore, Jr. Aug. 16, 1952. 49p. (NP-4802)

NP-4803

6421

American Spectrographic Labs.
SPECTROCHEMICAL ANALYSIS OF SILICATES AND OXIDES; QUARTERLY PROGRESS REPORT, DECEMBER 1952-FEBRUARY 1953, INCL. Charles E. Harvey. [nd] 13p. (NP-4803; AD-9864; Quarterly Progress Report 5)

NP-4812

6463

Armour Research Foundation
INVESTIGATION OF REFRACTORIES SUITABLE FOR MELTING TITANIUM AND ITS ALLOYS. SUMMARY REPORT FOR THE PERIOD APRIL 10, 1951 TO AUGUST 10, 1952. M. Eisenberg and J. A. Stavrolakis. Aug. 1952. 32p. (NP-4812; AD-6939)

NP-4815

6486

Metals Research Lab., Carnegie Inst. of Tech.
THE MECHANICAL PROPERTIES OF BAINITIC AND MARTENSITIC STEELS. ANNUAL SUMMARY REPORT FOR THE PERIOD FEBRUARY 1, 1952 TO FEBRUARY 1, 1953. Feb. 1, 1953. 101p. (NP-4815; AD-6153; Report 13)

NP-4817

6419

Physical Electronics Lab., Brown Univ.
CONTINUATION OF THE STUDY OF ADSORPTION OF GASES ON METAL SURFACES USING THE RADIOACTIVE TRACER TECHNIQUE. John A. Dillon, Jr. and H. E. Farnsworth. [Nov. 1952] 4p. (NP-4817; AD-3892; Technical Report 10)

NP-4820

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Climax Molybdenum Co. of Mich.
[PROTECTIVE COATINGS FOR MOLYBDENUM ALLOYS] FINAL REPORT FOR DECEMBER 6, 1950-MARCH 5, 1952. J. R. Blanchard. 38p. (NP-4820; ATI-160067)

NP-4823

6672

Duke Univ.
QUARTERLY PROGRESS REPORT, FEBRUARY 1, 1953 [TO] MAY 1, 1953. MICROWAVE SPECTRUM AND

- MOLECULAR STRUCTURE OF TRICHLORO GERMANE
Putcha Venkateswarlu, Richard C. Mockler, and Walter
Gordy. MICROWAVE SPECTRA AND MOLECULAR
STRUCTURES OF HSiCl_3 , CH_3SiCl_3 AND $(\text{CH}_3)_2\text{SiCl}_2$.
Richard C. Mockler, Jep H. Bailey, and Walter Gordy.
THEORY OF THE ROTATIONAL SPECTRA OF ALLENE-
TYPE MOLECULES. Masataka Mizushima. 67p. (NP-
4823; Report 1)
- NP-4825 6536
Chatham Electronics Corp.
TECHNICAL EVALUATION REPORT ON GAS REGULATOR
TUBES; INTERIM REPORT [FOR] JANUARY 1, 1953 -
MARCH 31, 1953. G. Edelcreek. Apr. 1953. 21p. (NP-
4825; AD-6777; Interim Report 2)
- NP-4826 6370
Institute for the Study of Rate Processes, Univ. of Utah
GENERAL THEORIES OF HETEROGENEOUS CATALYSIS.
Ransom B. Parlin, Merrill B. Wallenstein, Bruno J.
Zwolinski, and Henry Eyring. June 22, 1953. 101p.
(NP-4826; Technical Report 11)
- NP-4834 6543
Baird Associates, Inc.
PHOTOCHEMICAL SEPARATION OF ISOTOPES. PRO-
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JUNE 30, 1952. David Z. Robinson, Robert O'B. Carpenter,
and M. Kent Wilson. Aug. 29, 1952. 30p. (NP-4834;
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STUDY OF THE MICROSTRUCTURE OF CERMETS.
Harold M. Greenhouse and Herbert W. Newkirk. Mar. 1,
1953. 12p. (NP-4838; Bimonthly Report 12)
- NP-4840 6506
General Electric Research Lab.
CONFERENCE ON CRYOGENICS, SCHENECTADY, NEW
YORK, OCTOBER 6-7, 1952. 204p. (NP-4840)
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Duke Univ.
QUARTERLY PROGRESS REPORT. MAY 1, 1953 [TO]
AUGUST 1, 1953. [CONSISTS OF:] MICROWAVE SPECTRA
AND STRUCTURES OF METHYL MERCURY CHLORIDE
AND BROMIDE. Walter Gordy and John Sheridan. ONE-
TO-TWO MILLIMETER SPECTROSCOPY. PART II. H_2S .
Charles A. Burrus, Jr. and Walter Gordy. 52p. (NP-4841;
Report 2)
- NP-4845 6537
Arkansas Univ. Engineering Experiment Station
DEVELOPMENT OF AN INSTRUMENT FOR THE IN-
STANTANEOUS ANALYSIS OF GAS MIXTURES. QUAR-
TERLY PROGRESS REPORT, OCTOBER 1, 1952 TO
DECEMBER 31, 1952. Jan. 20, 1953. 11p. (NP-4845;
AD-8014; Quarterly Progress Report 4)
- NP-4852 6488
Institute of Engineering Research, Univ. of Calif., Berkeley
STATIC AND INTERMITTENT LOAD CREEP TESTS ON
COLD ROLLED COMMERCIAL PURE TITANIUM AT
400°F; CONSTANT LOAD CREEP TESTS ON ANNEALED
TITANIUM AT 400°F. Lawrence A. Shepard, C. Dean
Starr, Carl D. Wiseman, and John E. Dorn. May 1, 1953.
19p. (NP-4852; Progress Report 22)
- NP-4854 6522
Research Lab. of Electronics, Mass. Inst. of Tech.
METHODS OF MEASURING THE PROPERTIES OF
IONIZED GASES AT HIGH FREQUENCIES. 3. MEASURE-
MENT OF DISCHARGE ADMITTANCE AND ELECTRON
DENSITY. Sanborn C. Brown and David J. Rose. May 6,
1952. 12p. (NP-4854; Technical Report 230)
- NP-4859 6507
Little, Arthur D., Inc.
LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD
OF CRYOGENICS, WITH SUPPLEMENTS 1 AND 2. Oct.
1952. 82p. (NP-4859)
- NP-4866 6371
Notre Dame Univ.
EFFECT OF TEMPERATURE, SURFACE AND DIVERS
REAGENTS ON THE KINETICS OF THE VAPOR PHASE
REACTION, $2\text{NO}_2 + \text{ROH} \rightleftharpoons \text{HNO}_3 + \text{RONO}$ AT LOW PRES-
SURE. ANNUAL REPORT. July 1953. 13p. (NP-4866)
- NP-4873 6557
Evans Signal Lab., Signal Corps Engineering Labs.
AN INVESTIGATION INTO SCINTILLATION SPECTROSCOPY
AND ITS FEASIBILITY FOR ALPHA, BETA AND GAMMA
ENERGY DETERMINATIONS. Frank M. Urvinitka. Aug.
26, 1953. 34p. (NP-4873; M-1530)
- NP-4877 6575
Stanford Univ.
PHOTOPRODUCTION OF π -MESON PAIRS. R. D. Lawson.
Aug. 27, 1953. 25p. (NP-4877; Tech. Report 3)
- NP-4887 6489
Armour Research Foundation
DEVELOPMENT OF TRANSFORMATION DATA FOR
SPECIAL TITANIUM ALLOYS. [PROGRESS] REPORT FOR
THE PERIOD AUGUST 1, 1953 TO AUGUST 31, 1953.
D. J. DeLazaro and D. J. McPherson. 3p. (NP-4887;
[Progress] Report 2)
- NP-4892 6455
Allis-Chalmers Manufacturing Co.
DEVELOPMENT OF ELECTROMAGNETIC PUMPS SUIT-
ABLE FOR PUMPING LIQUID METALS. FINAL REPORT.
Jacob F. Asti. June 30, 1952. 318p. (NP-4892; Report
43-109)
- NP-4896 6490
Rem-Cru Titanium, Inc.
THE SKULL FURNACE POURING AND CASTING OF
TITANIUM SHAPES AND THEIR PROPERTIES; DEVELOP-
MENT OF PRODUCTION OF TITANIUM ALLOY CASTINGS
FOR ORDNANCE APPLICATION. INTERIM TECHNICAL
REPORT. [1953] 159p. (NP-4896; Interim Technical
Report 3)
- NP-4897 6491
Rem-Cru Titanium, Inc.
DEVELOPMENT OF PRODUCTION OF TITANIUM ALLOY
CASING CASTINGS FOR ORDNANCE APPLICATION.
FINAL TECHNICAL REPORT. May 14, 1953. 47p. (NP-
4897)
- NP-4898 6530
Engineering Research Inst., Univ. of Mich.
DEVIATIONS FROM THERMAL EQUILIBRIUM IN SHOCK
WAVES. [Hans] A. Bethe, Cornell Univ. and [Edward]
Teller, George Washington Univ. [nd] 82p. (NP-4898;
[BRL-X-117])
- NP-4901 6558
Technical Associates
TAPLIN DOSIMETER. FINAL REPORT. [May 1953] 14p.
(NP-4901)
- NP-4902 6492
Metals Research Lab., Case Inst. of Tech.
THE EFFECT OF PRESTRAINING UNDER DIFFERENT
STRESS STATES ON THE FRACTURE AND FLOW PROPER-
TIES OF 2S-O ALUMINUM; AN INVESTIGATION OF THE
EFFECTS OF STRESS CONCENTRATION AND TRIAXIAL-
ITY ON THE PLASTIC FLOW OF METALS. I. Rozalsky.
Oct. 1953. 48p. (NP-4902; Technical Report 28)

- NP-4903** **6395***
 Laboratory for Insulation Research, Mass. Inst. of Tech.
 THE CRYSTAL STRUCTURE OF BARIUM TETRASULFIDE
 MONOHYDRATE. S. C. Abrahams. Sept. 1953. 28p.
 (NP-4903)
- NP-4912** **6673**
 Baird Associates, Inc.
 TECHNICAL REPORT COVERING THE PERIOD JANUARY
 1, 1953 TO JULY 1, 1953. Robert O'B. Carpenter, Stanley
 J. Sage, and Norman Hapgood. 52p. (NP-4912)
- NRL-4044** **6465**
 Naval Research Lab.
 THE MANUFACTURE AND PROPERTIES OF PAPER
 MADE FROM CERAMIC FIBERS. Thomas D. Callinan
 and Robert T. Lucas. Oct. 20, 1952. 7p. (NRL-4044)
- NRL-4217** **6538**
 Naval Research Lab.
 A RADIO-FREQUENCY CIRCUIT FOR USE IN THE 300 TO
 1000 MEGACYCLE RANGE. Frank C. Isely. Aug. 7, 1953.
 17p. (NRL-4217)
- R-51TL006** **6493**
 Thomson Lab., General Electric Co.
 WELDING CHARACTERISTICS OF MATERIALS FOR
 [AIRCRAFT GAS TURBINE] APPLICATIONS. A. J.
 Rosenberg. Feb. 8, 1951. 126p. (R51TL006)
- R-94432-4-A** **6523***
 Westinghouse Research Labs.
 BREAKDOWN IN VACUUM UNDER THE INFLUENCE OF
 SOLID DIELECTRICS. P. H. Gleichauf and G. C. Thomas.
 Nov. 25, 1947. 26p. (R-94432-4-A)
- TEI-336** **6469**
 Geological Survey
 RECONNAISSANCE DURING 1952 FOR URANIUM-
 BEARING CARBONACEOUS ROCKS IN PARTS OF
 COLORADO, UTAH, IDAHO, AND WYOMING. James D.
 Vine and Robert F. Flege, Jr. June 1953. 19p. (TEI-336)
- WADC-TR-53-121** **6379**
 Power Plant Lab., Wright Air Development Center
 A NEW METHOD FOR THE DETERMINATION OF "TOTAL
 ACIDITY," NO₂ AND H₂O BY DIFFERENCE FROM THE
 SAME WEIGHED SAMPLE OF FUMING NITRIC ACID.
 Edward L. Harris. Apr. 1953. 16p. (WADC-TR-53-121;
 AD-9270)
- WADC-TR-53-201(pt.2)** **6373**
 National Bureau of Standards
 THERMAL CONDUCTIVITY AND HEAT CAPACITY OF
 MOLTEN MATERIALS. PART 2. THE HEAT CAPACITY
 OF ANHYDROUS SODIUM HYDROXIDE FROM 0° TO 700°C.
 Thomas B. Douglas and James L. Dever. Aug. 1953. 43p.
 (WADC-TR-53-201(pt.2))
- WAL-122/35** **6546**
 Watertown Arsenal Lab.
 GENERAL LITERATURE SURVEY OF MASS SPEC-
 TROMETRY AND REVIEW OF ANALYSES OF SOLID
 SAMPLES. George A. Consolazio and Laurence S. Foster.
 Aug. 15, 1952. 29p. (WAL-122/35; AD-5545)
- WIS-OOR-7** **6531**
 Naval Research Lab., Univ. of Wis.
 VIRIAL COEFFICIENTS AND MODELS OF MOLECULES
 IN GASES. Taro Kihara. June 5, 1953. 53p. (WIS-OOR-
 7; AD-13251)

NUCLEAR SCIENCE ABSTRACTS

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GENERAL

RESEARCH PROGRAMS

6322

Brookhaven National Lab.

ANNUAL REPORT; JULY 1, 1953. 144p. (BNL-246)

This annual report of Brookhaven National Lab. describes its program and activities for the fiscal year 1953. The progress and trends of the research program are presented along with a description and summary of the operational, service, and administrative activities. The scientific and technical details of the various research and development activities of the laboratory service organizations are treated fully, whereas the details of the research program are covered in summary. (For preceding period see BNL-196.) (auth)

BIOLOGY AND MEDICINE

6323

Worcester Foundation for Experimental Biology
HYDROCORTISONE IN NORMAL GUINEA PIG URINE:
ISOLATION AND QUANTITATIVE DETERMINATION.
Shlomo Burstein and Ralph I. Dorfman. [1953] 15p.
(AECU-2662)

Hydrocortisone was isolated and identified in the urine of adult male guinea pigs. This steroid appears to be the major urinary corticoid in this species. No increased amounts of extractable hydrocortisone could be demonstrated following incubation of the urines with spleen or bacterial β -glucuronidase over that extractable at pH 1, 5, or 7. A method is presented for the quantitative determination of hydrocortisone in guinea pig urine. (auth)

6324

Atomic Energy Project, Univ. of Calif., Los Angeles
A DETERMINATION OF THE RATE OF DEVELOPMENT
OF ACUTE PULMONARY EDEMA. B. Cassen and
K. Kistler. Submitted Oct. 15, 1953. 8p. (UCLA-268)

By the intravenous injection of Evans Blue dye at various time intervals after the initiation in rats of acute pulmonary edema by massive epinephrine administration and by comparing the color of edema fluid with that of blood plasma, it is shown that the bulk of the edema fluid is exuded very rapidly in about three minutes after the initiation of the syndrome. (auth)

5325

THE PATHS OF TRANSFORMATION OF CARBON COMPOUNDS IN A GREEN CELL. P. A. Kolesnikov. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Biol.* 3, 281-95 (1949). 32p. (UCRL-Trans-53)

AEROSOLS

5326

SEMI-PORTABLE AIR-SAMPLING SYSTEM. L. J. Leach, R. H. Wilson, K. E. Lauterbach, C. J. Spiegl, and S. Laskin.

Arch. Ind. Hyg. and Occupational Med. 8, 382-3(1953) Oct.

A semiportable air-pumping system for aerosol sampling with the cascade impactor and other dust samplers is described. In the laboratory, the unit has proved to be useful also for supplying air pressure or vacuum in many experiments. (auth)

RADIATION EFFECTS

6327

Tennessee Univ. Coll. of Agriculture

THE EFFECTS OF IRRADIATION FROM ATOMIC BOMB FALL-OUT UPON A GROUP OF HEREFORD CATTLE (THESIS). James Merrill Bird. Mar. 1952. 78p. (AECU-2695)

The general health, growth, breeding efficiency, and relative fertility of cattle exposed to irradiation from fallout from the first atomic bomb burst at Alamogordo, New Mexico, July 1945, were compared with that of a normal herd. No gross differences were found in the performance of the irradiated cattle and control cattle, or in their offspring. Effects of irradiation on the cattle were confined to the hair and skin. (C.H.)

6328

New England Deaconess Hospital, Boston
EFFECTS OF IONIZING RADIATIONS (AND OTHER AGENTS) ON THE DEVELOPING MAMMAL. Samuel P. Hicks, New England Deaconess Hospital, Boston and Harvard Medical School and Pondville Hospital, Walpole, Mass. [1953] 6p. (AECU-2697)

A timetable is presented for malformations resulting to fetal rats and mice following exposure of the mother to doses of x radiation ranging from 150 to 400 r during various stages of gestation. Data indicate the neuroblast is probably the mammalian cell most easily destroyed by ionizing radiations. Data are included from studies of the effects of anoxia, cytochrome oxidase reagents, hypoglycemia or interruption of glycolysis, radiomimetic drugs, sulfhydryl reagents, and cortisone and other steroids on developmental metabolism. From examination of the data it was concluded that radiation so specifically unlocks the metabolism of differential growth processes of the neuroblast and other analogous cells that it can damage the developing brain with virtually no effect on adult and more mature fetal tissues. (C.H.)

5329

Army Medical Research Lab., Fort Knox
HISTOPATHOLOGY OF THE RAT PITUITARY FOLLOWING TOTAL BODY X-IRRADIATION. Roy Korson and Albert L. Botkin. July 9, 1953. 11p. (AMRL-119)

Following total-body x irradiation the rat pituitary showed a depletion of basophilic granules and a decreased number of chromophobe cells. A concurrent and marked increase in pituitary acidophiles was noted starting at 24 hr post-irradiation. There was a gradual loss of water from the pituitary gland following x irradiation, with a slight but discernible cell shrinkage. The histological changes are in close agreement with functional alterations in the corresponding target endocrines, and this strongly suggests that the basophiles are the source of thyrotrophic hormone and the acidophiles the source of adrenocorticotrophic hormone.

Following total-body x irradiation there appears to be an increased elaboration of ACTH by the pituitary at the expense of the thyrotrophic hormone. (auth)

6330

Hanford Works
BIOLOGY RESEARCH. ANNUAL REPORT, 1952. July 7, 1953. 189p. (HW-28636)

Separate abstracts have been prepared on two sections of this report. (For preceding period see HW-25021.) (C.H.)

6331

Hanford Works
[PAGES 8-97 OF] ANNUAL REPORT [ON] BIOLOGY RESEARCH [FOR] 1952. July 7, 1953. 90p. (HW-28636(p.8-97))

Data obtained during the period from a radiobiological survey of the Columbia River indicated the distribution of radioactivity in river organisms to be similar to that of previous years. Tracer amounts of P^{32} introduced into aquaria were effectively removed by plankton and algae. Data are summarized on the effects of 3-yr retention in dilute reactor effluent on rainbow trout, and the effects of reactor effluent water on the eggs and young of salmon retained in reactor effluent for 11 months. Barley irrigated with various dilutions of reactor effluent water showed no effects attributable to radioactivity. Data are presented on the metabolism of T in the rat, the rate of percutaneous absorption of T from an HTO-contaminated atmosphere, long-term retention of T in the rat and sheep, the comparative metabolism of D and T in the rat, the metabolism of H isotopes by algae, and the metabolism of H isotopes in bean plants. Data are included on the gastro-intestinal absorption and eventual bone deposition of Pu by rats fed doses ranging from 0.04 to 1.2 times the maximum permissible concentration. The rates of absorption through the skin of rats were determined for various types of Pu solutions, and the effectiveness of various decontaminating agents and procedures in decontaminating skin were investigated. Prompt treatment with Zr citrate at a level of about 100 mg/kg resulted in removal of up to 85% of Pu(IV) and Pu(VI) administered intravenously to dogs. (C.H.)

6332

Hanford Works
[PAGES 98-185 OF] ANNUAL REPORT [ON] BIOLOGY RESEARCH [FOR] 1952. July 7, 1953. 88p. (HW-28636(p.98-185))

The relative biological effectiveness of β particles from T as compared to β particles from P^{32} was determined by a microbiological procedure to be 1.7. Studies are reported on the effect of radiation on the morphology of *L. casei*. The benzoate-phenol, $Fe^{+2} \rightarrow Fe^{+3}$, and $Ce^{+4} \rightarrow Ce^{+3}$ systems were evaluated as internal radiation dosimeters. Data are reported on the growth of algae in various concentrations of the β -emitting radioisotopes, P^{32} , S^{35} , Sr^{90} - Y^{90} , and H^3 . Data are included on the uptake by four species of plants of radioactive elements present in Jangle test-site soil and on a tracer study of the absorption of Ru from nutrient solution by kidney bean plants as a function of Ru concentration and pH. Tracer studies of the absorption of P, S, Ca, Mn, Zn, Cu, and Sr by *Chlorella* showed that the amount of the element absorbed by the algae is a function of the element and its concentration in the nutrient solution. Leaves of tomato and red kidney bean plants were exposed to I^{131} vapor and the per cent translocated to other plant parts was determined. The maximum translocation did not exceed 2%. A study of the toxicity of I^{131} in sheep was continued, and data are presented on general low-level chronic effects, early histologic damage in the thyroid, age of initial fetal thyroid function, the effect of desiccated thyroid and inert I on thyroid damage by toxic levels of I^{131} , and changes in

blood constituent following surgical and radiation thyroid damage. Biological radiation monitoring procedures were continued, and data are included on wildlife thyroid activity densities as related to vegetation activity densities and to I^{131} atmospheric contamination. (C.H.)

6333

RADIATION FROM FISSION MATERIALS FOR FOOD PRESERVATION. L. E. Brownell. Food Manuf. **28**, 383-6(1953) Oct.

Research by a number of investigators has shown that a variety of types of ionizing radiation can be used to destroy microorganisms. This has led to consideration of using ionizing radiation to sterilize foods and thereby prevent food spoilage resulting from the action of microorganisms. One such application might be the substitution of radiation sterilization for thermal sterilization in the processing of canned meats and other foods. An advantage of the use of radiation in the processing of canned foods would be the elimination of the requirement of processing at elevated temperatures. Another advantage would lie in the instant penetration of radiation, as compared to the slow penetration of heat. However, the use of radiation has numerous disadvantages and presents some new problems, described in this article. (auth)

6334

NEW STUDIES ON THE ROLE OF THE ADRENAL IN HEMATOPOIETIC REGENERATION AFTER IRRADIATION. H. Betz. Compt. rend. soc. biol. **147**, 168-70(1953) Jan. (In French)

Previous observations that adrenalectomy inhibits the normal hematopoietic regeneration in sublethally irradiated rats may have been the result of the traumatism observed after the transperitoneal removal of the adrenals following median laparotomy. It was decided to study the inhibition using an operation resulting in less shock to the system. Rats were adrenalectomized by two small subcostal incisions in the lumbar region, then, 4 days later, were whole-body irradiated with 500 r of 250-kv x rays. Observation of the liver and bone marrow showed that the adrenalectomy, far from inhibiting, actually stimulated hematopoietic regeneration. No regeneration took place in rats irradiated with an 800-r lethal dose, whether adrenalectomized or normal. (G.Y.)

6335

ACTION OF IRRADIATED CYTOPLASM ON UNTREATED CHROMOSOMES OF THE SILKWORM. Yoshio Nakao. Nature **172**, 625-6(1953) Oct. 3.

Genetic effects of irradiated cytoplasm on untreated introduced chromosomes were demonstrated by the appearance of mosaic eggs in the progeny of x-irradiated female silkworms of genotype *pe re/pe re*, mated to wild-type unirradiated males. Since it was considered that the mutagenic power of irradiated cytoplasm might be lost if the interval between irradiation and fertilization was too long, and in order to shorten the interval between irradiation and egg laying, the females were kept at about 10°C for 12 hr previous to irradiation, and the period within which mating was possible was restricted to 2 or 4 hr. (G.Y.)

6336

THE BREAKDOWN OF DESOXYRIBONUCLEIC ACID UNDER DEUTERON AND ELECTRON BOMBARDMENT. C. L. Smith. Arch. Biochem and Biophys. **46**, 12-17(1953) Sept.

Experiments have been performed by bombarding desoxyribonucleic acid (DNA) with high-energy deuterons and fast electrons and then assaying the bombarded material with desoxyribonuclease (DNase). The curves of dose against logarithm of residual activity are straight lines,

and from these a volume of $2140 \text{ \AA}^3$, cross-sectional area $500 \text{ \AA}^2$, and molecular weight of 2100 can be calculated. It is very tentatively suggested that these might possibly be the dimensions and molecular weight of those units into which DNA is broken down by its specific enzyme DNase. The experiment shows the importance of the method of assay when determining sensitive volumes by radiation methods since a similar experiment using a different method of assay gives a molecular weight of 6×10^6 . (auth)

6337

PRODUCTION OF HEPATIC STEATOSIS BY X RADIATION IN THE RAT. André Chevallier, C. Burg, and H. Spehler. *Compt. rend. soc. biol.* **147**, 497-500(1953) Mar. (In French)

Male Wistar rats of 200 to 210 g weight were irradiated daily until death with 50 to 500 r of 180-kv x rays. In order to control infection, 0.25 g of aureomycin was added to each 450 g of food. Fatty degeneration, not observed in an unirradiated control, was observed in all cases, but most notably in the animals receiving 50 r/day. (G.Y.)

6338

CURATIVE ACTION OF β -MERCAPTOETHYLAMINE IN THE RAT IRRADIATED WITH PROTECTED LIVER. J. Maisin, M. Mandart, G. Lambert, and H. Maisin. *Compt. rend. soc. biol.* **147**, 362-4(1953) Feb. (In French)

The therapeutic effect of β -mercaptoethylamine (2-aminoethanethiol) was demonstrated when injected intraperitoneally immediately after a lethal, 1130-r x irradiation during which the hepatic region was shielded. (G.Y.)

6339

EFFECT OF SOMATOTROPIC HORMONE ON HEMATOPOIETIC REGENERATION IN THE IRRADIATED RAT. H. Betz. *Compt. rend. soc. biol.* **147**, 171-3(1953) Jan. (In French)

Histological examination of the hematopoietic organs of rats at their death 10 days following an 800-r dose of 250-kv x rays, during which time they had been injected daily with growth hormone, showed neither lymphoid nor myeloid regeneration. Repetition of the experiment with adrenalectomized rats injected with cortisone showed that the somatotrophic hormone clearly stimulated the hematopoietic regeneration. It cannot be concluded that the inhibition of hematopoiesis following a lethal irradiation is due to a deficiency of the hormone, since the stimulating effect may be exerted upon the protein anabolism. It is possible that other substances would have the same anabolic properties. (G.Y.)

6340

THE EFFECT OF TEMPERATURE ON THE DIRECT ACTION OF IONIZING RADIATION ON CATALASE. Richard Setlow and Barbara Doyle. *Arch. Biochem. and Biophys.* **46**, 46-52(1953) Sept.

Crystalline liver catalase and noncrystalline red cell catalase have been inactivated by deuterons at temperatures from 90 to 380°K. The sensitivity versus temperature curves show three plateaus for red cell catalase which correspond to the inactivation of one quarter, one half, and the whole molecule. Crystalline liver catalase at a temperature T has a sensitivity equivalent to $(T + 60)$ for the noncrystalline red cell catalase. (auth)

6341

EFFECTS OF X-IRRADIATION ON AMOUNT AND COMPOSITION OF NUCLEIC ACIDS IN LIVER. Kenneth Paigen and Berwind N. Kaufmann. *J. Cellular Comp. Physiol.* **42**, 163-76(1953) Oct.

The effect of whole body irradiation by hard x rays on the nucleic acids of mouse liver was observed at various times after irradiation with a fixed dose of 600 r. The changes observed in the levels of nucleic acid were qualitatively identical for both DNA and PNA; that is, the

levels of both rose and fell together. There was an initial small drop, followed by a recovery at 12 hr to levels above those of the non-irradiated controls. A major drop occurred about 18 hr after exposure. This was followed by another rise, until at 48 hr after exposure the levels were well above those of the control values. Evidence was obtained that the reactions affected by irradiation are not involved in the interconversion of nucleic acids and free nucleotides. The sensitive reaction may precede the formation of nucleotides or other ultraviolet absorbing material, or the changes observed in liver may result from its function as a nucleic acid reservoir. The purine and pyrimidine contents of DNA and PNA isolated before and after exposure were determined by quantitative paper chromatography. With a dosage of 600 r, animals sacrificed 18 and 48 hr after exposure showed no change in nucleic acid composition when compared with nonirradiated controls. (auth)

6342

EFFECT OF X-IRRADIATION ON CONNECTIVE TISSUE GROUND SUBSTANCE. Robert H. Edgerley. *Am. J. Physiol.* **174**, 341-6(1953) Sept.

Two factorial experiments are presented in which the size of the connective tissue bullae of normal and x-rayed mice are compared for injections with isosmotic sucrose, hypertonic sucrose, and histamine solutions, and as measured at several different times after injection. The x-rayed mice received 500 r of whole-body 210-kv x rays approximately 24 hr before injection. The results, together with pertinent information in the literature, are discussed. (auth)

6343

CHOLINE STUDIES IN RATS FOLLOWING WHOLE-BODY X-IRRADIATION. Dorothy J. Buchanan, William J. Darby, E. B. Bridgforth, Granville W. Hudson, and J. Ann Efner. *Am. J. Physiol.* **174**, 336-40(1953) Sept.

The LD₅₀ at 30 days for female Sprague-Dawley albino rats weighing about 200 g was 665 ± 13 r in air or 858 ± 17 r with backscatter. No significant change in urinary choline excretion was observed in rats following irradiation with 500 r with backscatter. No differences were seen between the plasma alcohol-ether soluble choline of rats killed 1, 2 or 4 weeks after irradiation with 500 r including backscatter or 4 weeks after irradiation with 650 r including backscatter and the values for their pair-fed controls. Plasma alcohol-ether soluble choline and P were increased in fasted rats 48 hr following severe irradiation. The liver was also larger in proportion to body weight than the comparable controls, but the fat content of the organ was not raised. None of the irradiation effects observed were usable as indicators of early irradiation injury. (auth)

6344

EFFECT OF X-IRRADIATION UPON THE PERFORMANCE OF DAILY EXHAUSTIVE EXERCISE BY THE RAT. D. J. Kimeldorf, D. C. Jones, and T. J. Castanera. *Am. J. Physiol.* **174**, 331-5(1953) Sept.

Rats were required to perform daily in a standardized exhaustive exercise test (swimming) five times per week for periods as long as 9 weeks after x irradiation. Exposure to x-ray doses of 300 to 1,000 r depressed the ability to perform in this test. The magnitude of depression in performance was dependent upon the size of the x-ray dose. Irradiated animals surviving the period of testing recovered sufficiently by the ninth week after irradiation to attain their preirradiation performance level although they were not identical in performance with concurrently tested nonirradiated animals. Animals which died soon after irradiation were nearly normal in performance while animals which died later had a lower performance level varying with the length of the postirradiation survival period. (auth)

6345

A COMPARISON OF THE REACTIONS OF THE IRRADIATED PARTS OF THE BODIES OF TWO DAY OLD MICE AND URODELE AMPHIBIANS TO ROENTGEN TREATMENT. V. V. Brunst, E. A. Sheremetieva-Brunst, and Frank H. J. Figge. *Am. J. Roentgenol. Radium Therapy Nuclear Med.* **70**, 283-93(1953) Aug.

The reactions of the two-day-old mouse limb to x radiation were compared with reactions under similar conditions of the urodele amphibian limb. Histologic changes are described and illustrated photographically. The effects of irradiation on the two forms were found to be similar. (C.H.)

6346

EFFECT OF X RAYS IN WHOLE-BODY IRRADIATIONS ON THE THYROID GLAND OF WHITE RATS. J. Tusques, M. Berger, and R. Moret. *Compt. rend. soc. biol.* **147**, 337-9(1953) Feb. (In French)

White rats of the Wistar strain, whose diet has no peculiarity with respect to I content, were whole-body irradiated with a single 600-r dose of 200-kv x rays and then were sacrificed 2, 4, 24, or 48 hr later. Examination of the thyroids revealed lesions attributed to the direct destructive action of the x rays. This conclusion is contrary to those by most preceding investigators. (G. Y.)

6347

RESPONSE OF IRRADIATED CANCER PATIENTS TO *VIBRIO METSCHNIKOVII*. E. Staten Wynne, David B. Hinds, Cora L. Gott, W. O. Russell, and G. H. Fletcher. *Science* **118**, 442-3(1953) Oct. 16.

It has been reported that lymphopenia-inducing irradiation of patients with neoplastic diseases caused a marked decrease in production of H agglutinins toward *Salmonella paratyphi*. In order to determine whether these findings could be reproduced with a less sensitive system, the response to the fowl pathogen *Vibrio metschnikovii* by x-ray- or Ra-irradiated humans with a variety of malignant neoplastic diseases was investigated. The fowl pathogen was chosen with the hope that native antibodies would not be present; however, these were shown by over half the individuals. Results were negative, but the observed lack of effect on agglutinin formation would not appear to warrant a conclusion that immune defenses were in no way affected by irradiation. (G.Y.)

RADIATION HAZARDS AND PROTECTION

6348

Los Alamos Scientific Lab.

DETERMINATION OF SYSTEMICALLY DEPOSITED PLUTONIUM IN LABORATORY PERSONNEL AND A SIMPLE QUALITATIVE TEST FOR EXPOSURE TO AIRBORNE RADIOACTIVE MATERIAL. Louis H. Hempelmann and Wright H. Langham. Los Alamos Scientific Lab. and Rochester Univ. School of Medicine. [1953] 14p. (AECU-2633)

Twenty-seven cases of positive exposure to Pu occurring at the Los Alamos Scientific Lab. have been reported. The body Pu burden determined from urine assays ranged from 0.1 to 1.2 μg . Urinary Pu excretion curves are given for 9 of the 27 cases. Alpha counts of nose swabs taken during the employment period indicated that all 27 individuals had been subjected to some respiratory exposure. Not all persons showing positive nose swab counts gave positive urine assays for systemic Pu burdens. All of the 9 cases that were studied in detail showed a rough correlation between urine assays, positive nose swab counts, and the relative amounts of Pu processed during each month of exposure. The nose swab count is proposed as a simple test to supplement urine assays and to detect potential

respiratory exposure to airborne radioactive material and the practice of faulty laboratory procedure. (auth)

6349

PROTECTIVE EFFECT OF ACETYL-BETA-METHYLCHOLINE, CARBAMYLCHOLINE AND ATROPINE ON X-IRRADIATED MICE. W. T. Burnett, Jr., A. W. Burke, Jr., and A. C. Upton. *Am. J. Physiol.* **17**, 254-8(1953) Aug.

An abstract of this report was indexed as report AECU-1793 and appears in Nuclear Science Abstracts as NSA 6-1093.

6350

TRANSFER AGENTS AND CHEMICAL PROTECTION AGAINST IONIZING RADIATIONS. A. Prévot-Bernas. *J. chim. phys.* **50**, 445-6(1953) July-Aug. (In French)

The Ra γ -ray polymerization of acrylonitrile in the presence of the radioprotective chemical cysteine was studied in order to clarify the biological action of ionizing radiation. The mean molecular weight of the polyacrylonitrile obtained in the absence of cysteine was 235,000, whereas that of the polymer obtained in the presence of 0.01M, 0.05M, and 1.25M cysteine was 21,000, 5,800, and 2,200, respectively. Cysteine is thus a powerful transfer agent. This property may also be responsible for the decrease in total velocity of polymerization observed in the presence of cysteine. Thiourea, a less effective protective agent, is also a less active transfer agent. A 0.66M thiourea concentration reduces the molecular weight of polyacrylonitrile to 66,000. A parallelism is suggested between the transfer-agent property and that of radiomortality inhibition. (G.Y.)

6351

MEASUREMENT OF THE γ -RADIATION FROM THE HUMAN BODY. P. R. J. Burch and F. W. Spiers. *Nature* **172**, 519-21(1953) Sept. 19.

With the increasing use of radioactive isotopes in research, industry, and medicine, the need has arisen for an apparatus capable of measuring small quantities of these materials which, by accident, may have entered the body. Advance warning by a physical method is necessary if the deposition of radioactive substances in the body is to be kept below agreed maximum permissible levels. Direct measurement of the γ radiation emitted by radioactive elements in the body overcomes many of the ambiguities associated with the sole use of excretion tests. Given a sufficiently sensitive apparatus, it is even possible to detect quite small quantities of energetic β -particle emitters via the bremsstrahlung generated in the body tissues. The use of high-pressure differential ionization chambers to study body radioactivity at the University of Leeds is described. Probable errors are tabulated for observations of body activity resulting from Ra²²⁶, Th²³², Ra²²⁸, Co⁶⁰, I¹³¹, Na²⁴, and the β emitters P³², Sr⁹⁰, and Sr⁹⁰. (G.Y.)

6352

DETERMINATION OF TOTAL BODY RADIOACTIVITY USING LIQUID SCINTILLATION DETECTORS. F. Reines, R. L. Schuch, C. L. Cowan, Jr., F. B. Harrison, E. C. Anderson, and F. N. Hayes. *Nature* **172**, 521-3(1953) Sept. 19.

In the course of developing equipment for other problems, some measurements of the total radioactivity contents of several humans and a dog have been made using a technique which may have other applications in biophysics. The equipment used consists of a liquid scintillation detector in the shape of a cylinder 30 in. in diam. and 30 in. high, surrounded by RCA type 5819 photomultipliers, 45 of which were used in these measurements. Cylindrical steel inserts were placed in the tank, leaving an annular region filled with liquid scintillator (toluene-terphenyl- α -naphthyl phenyl oxazole). A Pb shield 5 in. thick was

placed around the assembly, leaving only the top of the insert open. Energy calibration and determination of counting efficiency for Ra and K^{40} in humans are reported. It is possible with a counter of this design to determine the total Ra content of the body at levels well below the present set tolerance (0.1 μ c), and to make similar determinations for any source giving sufficiently energetic γ rays. In the absence of the Ra group, the K content of the body can be measured with good accuracy, and it is quite conceivable that application of these techniques could yield important results in the study of the role of K in the metabolic process. (G.Y.)

6353

ROLE OF HOST DEFENSES IN STREPTOMYCIN TREATMENT OF X-IRRADIATED MICE. Robert Q. Marston, H. Jeanette Ruth, and Willie W. Smith. Proc. Soc. Exptl. Biol. Med. 83, 289-91(1953) June.

The intravenous injection of a homogenate of immature spleen increased the resistance of sub-lethally irradiated mice to *Proteus* infection and significantly complemented the action of streptomycin. (auth)

6354

EFFECT OF SOYBEAN PHOSPHATIDE ON BLOOD COAGULATION DEFECT FOLLOWING TOTAL BODY X-IRRADIATION IN THE DOG. Sidney G. White, John B. Lagen, Paul M. Aggeler, and Robert P. Geyer. Proc. Soc. Exptl. Biol. Med. 83, 384-7(1953) June.

Thrombocytopenia, prolonged whole blood clotting time, and markedly impaired clot retraction and prothrombin utilization were induced in dogs by 150 r total-body x irradiation. A marked increase in prothrombin utilization was found after the addition of a soybean phosphatide solution to the blood in vitro. A temporary decrease in the clotting time and an increase in prothrombin utilization, without change in the platelet count or clot retraction, was induced by the intravenous administration of 20 to 100 ml of a 2.5% solution of the soybean phosphatide. (auth)

RADIOTHERAPY

6355

RADIOACTIVE GOLD-198 FOR GAMMA RADIATION THERAPY. William G. Myers, Benjamin H. Colmery, Jr., and Waldron M. McLellon. Am. J. Roentgenol. Radium Therapy Nuclear Med. 70, 258-73(1953) Aug.

The applicability of Au^{198} for the preparation of permanent seed implants to provide removable linear sources for interstitial γ -radiation therapy was investigated. Applications in preliminary animal studies demonstrated that they produced regressions in transplanted tumors. (C.H.)

TOXICOLOGY STUDIES

6356

MODE OF ACTION OF BERYLLIUM ON ALKALINE PHOSPHATASE. A. Veerkamp and G. Smits. Nature 172, 589-90 (1953) Sept. 26.

Studies on alkaline phosphatase inhibition in vitro with reaction mixtures consisting of 0.5 ml buffer (barbital-HCl), 0.1 ml enzyme solution (normal tissue extracts as well as dialyzed (phosphate-free) and purified enzyme solutions were used), 0.1 ml substrate solution (= 4 mg Na β -glycerophosphate), 0.1 ml H_2O or $BeCl_2$ solution $8 \times 10^{-4}M$, final pH 9.6, showed that the inhibiting form of Be is eliminated by filtration. This leads to the conclusion that the inhibition of alkaline phosphatase in vitro is caused by interaction between precipitated $Be(OH)_2$ and the enzyme, perhaps by coprecipitation. In the authors' opinion, the inhibition in vitro bears no relation to the action of Be in vivo, notwithstanding the suggestion to the contrary by the develop-

ment of rickets-like bone lesions on administration of Be salts to rats. (G.Y.)

TRACER APPLICATIONS

6357

Harvard Univ.

PROGRESS REPORT. Jan. 1, 1953. 33p. (AECU-2652)

Progress is reported in clinical studies involving the use of radioisotopes as tracers and in therapy. Abstracts are included of reports prepared for publication covering completed studies. (C.H.)

6358

Anesthesia Lab., Harvard Medical School

BRAIN POTASSIUM EXCHANGE IN NORMAL ADULT AND IMMATURE RATS (thesis). Robert Katzman and P. Herbert Leiderman, Anesthesia Lab., Harvard Medical School and Biophysical Lab., Harvard Medical School. [1953] 30p. (AECU-2677)

Sixty-eight normal adult male rats were injected intraperitoneally with radioactive K. The animals were sacrificed at intervals of 4, 16, 39, 54, and 72 hr by decapitation, and plasma and brain activity and total K were measured. The general exchange equation, $d(K^{42})_{br}/dt = k_1(K^{42})_{pl} - k_2(K^{42})_{br}$, was solved by graphical methods for the transport coefficients k_1 and k_2 and from these values the influx and outflux were calculated. Similar studies were done on animals 4, 15, and 35 days old and on animals more than 18 months old. The influx of K into the brain of normal adult rats was found to be 2.89 meq/kg/hr, the outflux rate 3.64 meq/kg/hr, and the influx/outflux ratio 0.80. Since a steady state obtains, the outflux must be equivalent to influx. Therefore 20 meq of K per kg of wet brain is not exchangeable with K^{42} . The influx in 4-day- and 15-day-old animals is 3.9 meq/kg/hr and in 35-day animals the influx is 3.1 meq/kg/hr. All brain K was found to be exchangeable in 4-, 15-, and 35-day rats. Brain K exchange in older rats was found to be similar to that of normal young adults. (auth)

6359

Anesthesia Lab., Harvard Medical School

EFFECT OF ADRENALECTOMY, DESOXYCORTICOSTERONE, AND CORTISONE ON DRAIN-POTASSIUM EXCHANGE (thesis). P. Herbert Leiderman and Robert Katzman, Anesthesia Lab., Harvard Medical School and Biophysical Lab., Harvard Medical School. [1953] 23p. (AECU-2689)

Thirty-four rats were adrenalectomized in a one-stage procedure, maintained on saline for five to six days postoperatively, and then injected intraperitoneally with radioactive K. The animals were sacrificed 4, 16, 39, or 54 hr later by decapitation, and plasma and brain activity and total K were measured. The general exchange equation was solved by graphical methods for the transport coefficients k_1 and k_2 , and from these values the influx and outflux were calculated. The effects of saline, desoxycorticosterone and cortisone were studied in a similar manner at 4, 16, and 39 hr. Adrenalectomy did not appreciably change the influx for K into rat brain. However, the ratio of influx to outflux indicated that all brain K is exchangeable. In contrast, normal animals have a non-exchanging compartment amounting to 20 meq/kg brain. Cortisone in adrenalectomized animals restored the non-exchangeable compartment, while DOCA and saline did not. Despite varying plasma K levels the K influx into brain was approximately the same, suggesting that the K system for brain is a carrier limited one. (auth)

6360

THE STUDY OF METABOLIC TURNOVER RATES BY MEANS OF ISOTOPIC TRACERS. I. FUNDAMENTAL RE-

LATIONS. John M. Reiner. *Arch. Biochem. and Biophys.* 46, 53-79 (1953) Sept.

A formal definition of rate of turnover, in agreement with general usage, has been proposed, and compared with informally defined quantities frequently used. The prerequisites for the calculation of turnover rates from experimental data have been determined. It is found that the calculation of turnover rate for any component of a metabolic network requires a complete knowledge of the structure of that network, as well as experimental study of the concentrations and specific activities of all its components. A reasonably complete time curve for each component must be obtained. The above general definition of turnover rate proves to be inadequate when reactions of order higher than the first occur. When a compound to be labeled with isotope may be labeled in more than one position within the molecule, the various species of labeled molecules must be dealt with separately, both theoretically and experimentally. Only in some specially simple cases is it possible to combine the equations for the various labeled species into a single one for the compound as a whole. These points are illustrated by means of a study of CO_2 fixation through the tricarboxylic acid cycle. The consequences of these findings are discussed. Particular consideration is given to the problem of systems whose metabolic structure is not completely known. Conditions under which data obtained on such systems may be at least approximately interpreted in terms of metabolic rates are described. (auth)

6361

THE STUDY OF METABOLIC TURNOVER RATES BY MEANS OF ISOTOPIC TRACERS. II. TURNOVER IN A SIMPLE REACTION SYSTEM. John M. Reiner. *Arch. Biochem. and Biophys.* 46, 80-99 (1953) Sept.

The chemical kinetic equations for a simple metabolic scheme have been solved in general terms. The scheme is one which may be regarded as an approximate representation of a number of interesting metabolic situations. The special forms of the solution which result from several common sets of experimental conditions have been studied in detail. Some approximate solutions to the foregoing system, used by various authors for the isotopic study of protein turnover, have been examined and the validity of the approximations has been considered. The problem of growth induction—whether it is due to increased rate of synthesis or decreased rate of catabolism—has been considered in the light of the equations, and the possibilities for settling the question in terms of data on isotope incorporation have been discussed. The problem of the heterogeneity of metabolic pools within the organism has been discussed at length, and some proposals for a more rigorous experimental analysis have been formulated. (auth)

CHEMISTRY

8363

Radiation Lab., Univ. of Calif., Berkeley
CHEMISTRY DIVISION QUARTERLY REPORT [FOR]
MARCH, APRIL, MAY 1953. June 25, 1953. Decl.
Aug. 25, 1953. 76p. (AECD-3555; UCRL-2257)

Progress is reported on the following problems: Yb, Tm, and Er isotopes from the high-energy spallation of Ta; Tl isotopes from He-ion bombardment of air; photon spectrum from decay of Am^{241} ; relative yields of Co^{58} and Co^{59m} from the (α, n) reaction in Mn; patterns in α spectra of even-even nuclei; irradiation of $\text{Ce}(\text{SO}_4)_2$ and HCO_2H ;

ruling fine lines on quartz; the role of thioctic acid in the Hill reaction; S^{35} -labeled 6-thioctic acid; synthesis of 6-thioctic acid; synthesis of labeled organic compounds (palmitic-1- C^{14} acid and glyceryl tripalmitate-1- C_3^{14}); metabolism of fatty acids by pantothenic acid-deficient rats; studies on adenine metabolism; construction of Co^{60} γ -ray source; and effects of high-energy radiation on organic compounds. (For preceding period see UCRL-2179.) (J.A.G.)

6363

Battelle Memorial Inst.

THE SURFACE REACTION BETWEEN OXYGEN AND THORIUM. A. F. Gerds and M. W. Mallett. May 26, 1953. Decl. Aug. 5, 1953. 20p. (AECD-3577; BMI-830)

The rate of reaction of O_2 with arc-melted and rolled iodide Th has been found to obey the parabolic rate law in the temperature range of 850 to 1415°C at 1 atm pressure. The rate constant can be expressed as $k = 6 \times 10^7 \exp(-63,300/\text{RT}) \text{ cm}^2/\text{sec}$. The energy of activation, 63,300 cal/mole, has a probable error of 2,100 cal/mole. (auth)

6364

Battelle Memorial Inst.

THE REACTION OF NITROGEN WITH THORIUM AND THE DIFFUSION OF NITROGEN IN THORIUM. A. F. Gerds and M. W. Mallett. May 26, 1953. Decl. Aug. 5, 1953. 22p. (AECD-3578; BMI-831)

The rate of reaction of N with Th was determined for the temperature range of 670 to 1490°C at 1 atm. pressure. The reaction follows a parabolic law, and the parabolic rate constant in square centimeters per second has been calculated to be $k = 5.9 \exp(-24,300/\text{RT})$, where $24,300 \pm 1,300$ cal/mole is the activation energy of reaction. The rates of diffusion of N in Th were obtained over the temperature range of 845 to 1490°C at atmospheric pressure. The diffusion coefficient in square centimeters per second is $D = 2.1 \times 10^{-3} \exp(-22,500/\text{RT})$. The energy of activation of diffusion, 22,500 cal/mole, has a probable error of 1,300 cal/mole. The limiting solubilities of N in Th were determined from the diffusion data. The heat of solution of N in Th is 11,000 cal/mole. (auth)

6365

Los Alamos Scientific Lab.

REACTION OF THALLIUM WITH OXYGEN AND MOISTURE. J. T. Waber and G. E. Sturdy. [1953?] 16p. (AECU-2669)

Corrosion tests were made on high purity Tl in air, O_2 , and He atmospheres and at temperatures from 38 to 130°C. It was concluded that the observed change in the growth law from the cubic to the $1/2$ -power time dependence as the relative humidity is increased is associated with a change from the formation of Tl_2O to the formation of TlOH as the principal product. The reaction of Tl with H_2O vapor in the low humidity range and the hydration of Tl_2O in the higher humidity range appear to be the dominant reactions. The change in reaction occurs at 30% relative humidity at 38°C. A sulfide film has a slight inhibitory effect on the corrosion rate. (J.S.R.)

6366

Los Alamos Scientific Lab.

KINETICS OF THE ALKALINE DECOMPOSITION OF 1,3-DINITRO-1,3-DIAZACYCLOPENTANE. Walter H. Jones. [1953] 6p. (AECU-2693)

The kinetics of the reaction of 1,3-dinitro-1,3-diazacyclopentane with methoxide ion in absolute methanol were measured and a reaction mechanism suggested. (J.S.R.)

6367

Argonne National Lab.

THE STRUCTURE OF THE PERRHENATE ION. Howard H. Claassen and A. J. Zielen. Sept. 8, 1953. 8p. (ANL-5116)

Raman and infrared spectra have been obtained for aqueous solutions of HReO_4 and NaReO_4 . The spectra are interpreted satisfactorily with the assumption that the perrhenate ion in dilute solutions has the tetrahedral symmetry, ReO_4^- . (auth)

6368

Wisconsin Univ.

THE PREPARATION AND PROPERTIES OF ZIRCONIUM AND HAFNIUM CHELATES OF CERTAIN β -DIKETONES. Edwin M. Larsen, Glenn Terry, and James Leddy. Aug. 3, 1953. 20p. (NP-4760; Technical Report 5)

Compounds of Zr and Hf with the composition MK_4 have been prepared with the following diketones: acetylacetone, trifluoroacetylacetone, 2-furoylacetone, 2-furoyltrifluoroacetone, 2-thenoylacetone, 2-thenoyltrifluoroacetone, and 2-pyrrolyltrifluoroacetone. The densities of the chelate compounds were determined by the standard pycnometric method using H_2O or petroleum ether saturated with the chelate as the immersion liquid. The molecular volumes calculated, in all cases, were greater for the Hf compound than the Zr compound except for acetylacetone and 2-pyrrolyltrifluoroacetone derivatives where the molecular volumes were almost identical. The ultraviolet absorption spectra for the non-fluorine-containing chelate compounds in cyclohexane are similar to the parent diketones. For the metal derivatives of the fluorinated diketones, the λ_{max} associated with the enol ring is shifted to longer wave lengths, as compared to the λ_{max} of the free diketone. The λ_{max} for the Zr chelates shifted to slightly longer wave lengths than for the corresponding Hf compound. (auth)

6369

University of Southern Calif.

ENERGY TRANSFER PROCESSES IN REACTION KINETICS; TECHNICAL REPORT [FOR] PERIOD JUNE 19, 1952-JUNE 18, 1953. Sidney W. Benson, Arthur E. Axworthy, Jr., Charles Cousin, and Gerald B. Porter. July 15, 1953. 118p. (NP-4767; Technical Report 1)

The various approaches that are being made to the problem of finding suitable systems for the investigations of energy-transfer processes are presented in six sections of the report. These include: (1) the role of collision processes in unimolecular and bimolecular processes; (2) reactions of CO with free radicals; (3) temperature gradients in gas and liquid systems undergoing energetic reactions; (4) infrared fluorescence; (5) wall effects in chain reactions, with the recombination of I atoms being specifically studied; and (6) the mechanism of the thermal decomposition of N_2O . In some cases the results of experimental measurements are presented, whereas in others only theoretical aspects or preliminary experiments are discussed. (L.M.T.)

6370

Institute for the Study of Rate Processes, Univ. of Utah
GENERAL THEORIES OF HETEROGENEOUS CATALYSIS. Ransom B. Parlin, Merrill B. Wallenstein, Bruno J. Zwolinski, and Henry Eyring. June 22, 1953. 101p. (NP-4826; Technical Report 11)

The mobile monolayer, localized monolayer, and BET theories of ideal gaseous adsorption on catalysts are discussed. The statistical equations of chemical adsorption are derived. The actual or non-ideal adsorption on catalysts is discussed on the basis of a priori heterogeneity, induction effects, and lateral interactions. The energetics of adsorption and reaction is one of the fundamental problems of catalytic reactions. The thermodynamics and statistical mechanical treatment of adsorption are evalu-

ated. A kinetic formulation developed from recent investigations is presented. Examples of catalytic surface reactions are analyzed. A theory of the nature of the activated complex is presented and applied to the catalytic hydrogenation of C_2H_4 . Some of the more pertinent work with respect to the types of catalysts are summarized. The relationships and correlations that have been found and which can be considered as hypotheses of the mode of operation of catalytic action are indicated. 196 references. (J.S.R.)

6371

Notre Dame Univ.

EFFECT OF TEMPERATURE, SURFACE AND DIVERS REAGENTS ON THE KINETICS OF THE VAPOR PHASE REACTION, $2\text{NO}_2 + \text{ROH} \rightleftharpoons \text{HNO}_3 + \text{RONO}$ AT LOW PRESSURE. ANNUAL REPORT. July 1953. 13p. (NP-4866)

The temperature effect was determined on NO_2 -alcohol reactions at a partial pressure up to 10 mm Hg for all components used. The rate was followed photometrically, the NO_2 concentration being determined as a function of time. The complete experiment and apparatus are discussed. Data are presented on the effect of NO, NO_2 , nitrite esters, HNO_3 , acetaldehyde, temperature, pressure, and ethanol on the reaction rate. (J.A.G.)

6372

Cornell Univ.

THE CHEMISTRY OF THE HETEROPOLY ACIDS (thesis). C. E. Erickson. Jan. 1951. 36p. (NYO-3548)

The properties of the 12-acids and their compounds, phosphotungstates, phosphomolybdates, silicotungstates and silicomolybdates, intermediate compounds related to other 12-acids, and the 6-acids and their salts are reviewed. 71 references. (J.A.G.)

6373

National Bureau of Standards

THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 2. THE HEAT CAPACITY OF ANHYDROUS SODIUM HYDROXIDE FROM 0° TO 700°C. Thomas B. Douglas and James L. Dever. Aug. 1953. 43p. (WADC-TR-53-201(pt.2))

Samples of NaOH whose purity analyses were approximately 99.3% were sealed in pure Ag. Cryoscopic measurements indicated a freezing point of 317° and a transition temperature of 293°C. By using a "drop" method and a Bunsen ice calorimeter, the enthalpy change between 0° and each of eleven temperatures up to 700°C was measured. With reasonable assumptions, the thermal measurements near the freezing point were used to correct for the impurity, giving, for pure NaOH, a melting point of 319°C and heats of fusion and transition of 159 and 158 absolute J/g, respectively. The heat capacity derived for the liquid is estimated to be correct within 2%. Values of heat capacity, entropy, relative enthalpy, and relative free energy are tabulated between 298° and 1000°K. (auth)

6374

A MODIFIED ISOTOPIC EXCHANGE RATE EXPRESSION. Rowland E. Johnson. J. Chem. Phys. 21, 1405-6(1953) Aug.

A new isotopic exchange rate expression was derived from the common rate expression for isotopic exchange reactions by assuming that the total amount of activity of tracer remains constant because the tracer isotope is in secular or transient equilibrium with its parent. Theoretical uses and conditions of the new expression are discussed. (J.A.G.)

ANALYTICAL PROCEDURES

6375

Knolls Atomic Power Lab.

DETERMINATION OF SODIUM MONOXIDE IN SODIUM.

AN ADDENDUM. L. P. Pepkowitz, W. C. Judd, and R. J. Downer. Aug. 5, 1953. 9p. (KAPL-972)

Modifications made in a previously presented method (NSA 5-3645) for the determination of Na_2O in Na resulted in greater precision. The modifications involved increased purification of the blanket gas and heating the extractor during the amalgamation step. This procedure can be applied to Na-K and Li. (J.S.R.)

6376

Pitman-Dunn Labs., Frankford Arsenal
COLORIMETRIC DETERMINATION OF SMALL AMOUNTS OF BORON IN TITANIUM ALLOYS. M. Codell and G. Norwitz. Aug. 1952. 18p. (MR-518; ATI-168254)

An accurate method is proposed for the colorimetric determination of small amounts of B (0.0000 to 0.10%) in Ti alloys. The sample is dissolved in H_2SO_4 , and the borides are oxidized with H_2O_2 . The H_2O_2 is destroyed by boiling the solution with an Fe salt, which acts as a catalyst for the decomposition of the H_2O_2 . The B is distilled as methyl borate, and the alcohol is removed by adding NaOH and NH_4OH and evaporating to dryness. The B is then determined colorimetrically with dianthramide. (auth)

6377

Pitman-Dunn Labs., Frankford Arsenal
COLORIMETRIC DETERMINATION OF CHROMIUM IN TITANIUM ALLOYS. G. Norwitz and M. Codell. Apr. 1953. 15p. (MR-549; AD-9590)

A colorimetric procedure for the determination of 0.02 to 4% Cr in Ti alloys is proposed. The Cr is oxidized to the chromate state by means of NH_4 -persulfate and KMnO_4 in the presence of AgNO_3 as a catalyst. Diphenylcarbazide is then added to an aliquot of the solution, and the violet color is read in 10 to 40 min at 580 m μ . None of the elements found in commercial alloys interfered with the method. (J.A.G.)

6378

Armour Research Foundation
A STUDY OF RADIOMETRIC TECHNIQUES FOR EVALUATING THE URANIUM CONTENT OF ROCKS AND MINERALS. FINAL REPORT. C. A. Stone and L. Reiffel. Issued June 1953. 28p. (RME-3053)

The apparatus and techniques used in evaluating the U content of rocks and minerals are described. Experimental results indicate that the 95-kv γ ray resulting from the β decay of Th^{234} offers the best means of identifying U by radiometric techniques. The present resolution of scintillation spectrometers is not sufficient to permit a direct analysis, but the resolution of proportional counters is sufficient. A subtraction technique based on the scintillation spectrum works for comparatively high U contents and low Th to U ratios but does not provide a practical solution to the problem. (J.E.D.)

6379

Power Plant Lab., Wright Air Development Center
A NEW METHOD FOR THE DETERMINATION OF "TOTAL ACIDITY," NO_2 AND H_2O BY DIFFERENCE FROM THE SAME WEIGHED SAMPLE OF FUMING NITRIC ACID. Edward L. Harris. Apr. 1953. 16p. (WADC-TR-53-121; AD-9270)

A new procedure is proposed for the analysis of fuming HNO_3 . The procedure makes possible the determination of HNO_3 content, NO_2 , and H_2O by difference from a single weighed sample of fuming HNO_3 . HNO_3 content is determined differentially by titrating the acidic constituents (HNO_3 , NO_2) with 0.5N alkali to the end point (pH = 7.6). At the equivalence point, samples of fuming HNO_3 (NO_2 contents 0.0% to 10%) titrated with base gave pH values of 7.6. NO_2 is determined by titrating the above neutralized sample with 0.1N $\text{Ce}(\text{SO}_4)_2$ in 1 molar H_2SO_4 , using ferroin as indicator.

Water content is obtained by subtracting the differentially determined HNO_3 and NO_2 contents from 100%. A typical calculation for the determination of the constituents is illustrated. Titrations are carried out with calibrated constant temperature H_2O -jacketed burets. End points for titrations are obtained by using potentiometric instruments or suitable indicators (neutral red and ferroin). Results of successive determinations for per cent water by difference are duplicated within an error limit of 0.0 to 0.05%. (auth)

6380

A NEW REAGENT FOR THE GRAVIMETRIC AND VOLUMETRIC ANALYTICAL DETERMINATION OF NITRATE ION. Helmut Hartmann and G. Bathge. Translated by Margaret L. Schloo from *Angew. Chem.* 65, 107-9(1953). 7p. (AEC-tr-1686)

The dicyclohexylthallium (III) ion permits the quantitative determination of nitrate ions gravimetrically as well as by the volumetric determination of the flocculation point. Illustrative analysis and details and modifications of the procedure are given. (auth)

6381

RADIUM DETERMINATION BY ALPHA COUNTING. H. W. Kirby. *Anal. Chem.* 25, 1238-41(1953) Aug.

A method is described which reduces the amount of labor and equipment involved in the assay of carrier-free Ra and improves the precision and accuracy of the determination. A dilute HCl solution of the Ra sample is passed through a short column of Cu powder to remove Po. The effluent is mounted on glass disks and α -counted 4 to 5 hr after mounting. Twenty-four hours after mounting, the samples are counted again and the percentage increase in counts is used to determine a correction factor for the growth of Rn and its daughters. A sample certified by the National Bureau of Standards as containing $100 \pm 0.7 \mu\text{g}$ of Ra was found to contain $99.7 \pm 0.6 \mu\text{g}$ when analyzed by the method described. The method is applicable to Ra stock solutions and other samples of Ra which are relatively carrier-free. (auth)

6382

QUALITATIVE TEST FOR SCANDIUM EMPLOYING 2,5-DIHYDROXY-1,4-BENZOQUINONE. Lewis Pokras and Martin Kilpatrick. *Anal. Chem.* 25, 1270-2(1953) Aug.

A solution of 2,5-dihydroxy-1,4-benzoquinone in acidified alcohol produced a pinkish precipitate with Sc in the presence of large concentrations of Na and ammonium salts. The effects of various ions on this reaction were studied. Oxalate and phosphate inhibited the reaction completely; fluoride appeared to increase the sensitivity. The lowest concentration of Sc (as chloride) which yielded a positive test in 15 min was $3 \times 10^{-4}\text{M}$. (J.A.G.)

6383

COLORIMETRIC MICRODETERMINATION OF BORON BY THE CURCUMIN-ACETONE SOLUTION METHOD. Louis Silverman and Katherine Trego. *Anal. Chem.* 25, 1264-7(1953) Aug.

The effects of variations of the amounts of reagents used in the B-curcumin reaction, as applied to the colorimetric determination of boric acid or borate in solutions of low solids content, were studied. The procedure is effective in H_2O solutions for the determination of detectable amounts of B (0.02 μg contained in a 10-ml standard volume of solution plus reagents). Precautions are described which must be observed with reagents and apparatus in order to avoid contamination at low B contents (0.1 μg or less). (J.A.G.)

6384

QUANTITATIVE INSOLUBILITY OF THORIUM OXALATE. Harold L. Kall and Louis Gordon. *Anal. Chem.* 25, 1256-8(1953) Aug.

Since oxalate is widely used for determination of Th, the

solubility loss of Th oxalate in dilute acid media was investigated. In general, the presence of ammonium salts increased the solubility loss. A slight variation in concentration of oxalate did not affect the solubility appreciably, but a very large excess tended to increase the loss. The presence of rare earths which were also precipitated by the oxalate and thus served as carriers for the Th decreased the solubility. A study of the solubility losses encountered in several standard oxalate procedures showed that quantitative precipitation was approached in three of the procedures. It is concluded that Th oxalate is not as quantitatively insoluble as one would infer from the literature, and that oxalate procedures for determination of Th should be avoided when possible. (J.A.G.)

6385

PREPARATION AND PROPERTIES OF 2-(2-HYDROXY-3,6-DISULFO-1-NAPHTHYLAZO)-BENZENEARSONIC ACID (THORIN); ANALYTICAL REAGENT FOR THORIUM. D. W. Margerum, Carol H. Byrd, S. A. Reed, and Charles V. Banks. *Anal. Chem.* **25**, 1219-21(1953) Aug.

The increasing importance of 2-(2-hydroxy-3,6-disulfo-1-naphthylazo)-benzenearsonic acid (Thorin) as an analytical reagent for Th has brought about a great need for more detailed information as to its preparation and properties. A detailed procedure for the synthesis of Thorin is given. The nature of the Th-Thorin complexes was studied, and the acid dissociation constants of Thorin were determined. These constants, $pK_1 = 3.7$ and $pK_2 = 8.3$ for the arsono hydrogens and $pK_3 = 11.8$ for the naphtholic hydrogen, were determined by potentiometric titration and spectrophotometric means. This information should be useful in more extensive applications of this sensitive reagent. (auth)

6386

SIMULTANEOUS COLORIMETRIC DETERMINATION OF COPPER, COBALT, AND NICKEL AS DIETHYLDITHIOCARBAMATES. J. M. Chilton. *Anal. Chem.* **25**, 1274-5 (1953) Aug.

A method for the simultaneous colorimetric determination of small amounts of Cu, Co, and Ni as diethyldithiocarbamates is given. This involves the formation of the carbamates at a pH of 8.5 to 9.0 in an aqueous solution to which pyrophosphate and citrate have been added and subsequent extraction of the colored complexes with CCl_4 . The absorption spectra of each of the compounds dissolved in CCl_4 are given. Four classes of ions that interfere in the method and methods of relieving this interference are given. (J.A.G.)

6387

COLORIMETRIC DETERMINATION OF MOLYBDENUM WITH MERCAPTOACETIC ACID. Fritz Will, III and John H. Yoe. *Anal. Chem.* **25**, 1363-6(1953) Sept.

The purpose of this investigation was to study the reactivity of mercaptoacetic acid with inorganic ions, in particular the molybdate ion, and to develop a colorimetric method for determining Mo, especially in materials containing large amounts of Fe. Procedures have been developed for the colorimetric determination of Mo in the presence or absence of Fe, and also for the determination of both Mo and Fe in the same aliquot. The method is simple and accurate and should be useful for the determination of Mo in steels, molybdates, and other materials, especially those containing large amounts of Fe. (auth)

6388

PHOTOMETRIC DETERMINATION OF COLUMBIUM, TUNGSTEN, AND TANTALUM IN STAINLESS STEELS. Luther Ikenberry, J. Leo Martin, and W. J. Boyer. *Anal. Chem.* **25**, 1340-4(1953) Sept.

The increased use of ferroniobium containing appreciable amounts of Ta (5 to 25%) has made it necessary to determine

the Ta as well as the Nb content of Type 347 stainless steel. These steels often contain varying amounts of W which inadvertently gets into the melt with the scrap. Nb, W, and Ta are readily separated as a group by the conventional hydrolysis scheme. Photometric procedures have been developed for determining these 3 elements after the group separation. The Nb and W are determined by additive absorbancies utilizing the color reaction with hydroquinone, and the Ta is determined by utilizing the color reaction with pyrogallol acid. The method was found to be satisfactory when applied to the mixed oxides of Nb, W, and Ta after a preliminary group separation. This scheme can also be applied to the mixed oxides obtained from other materials such as ores and slags. (auth)

6389

SMALL AMOUNTS OF URANIUM IN THE PRESENCE OF IRON; COLORIMETRIC DETERMINATION WITH 8-QUINOLINOL. Louis Silverman, Lavada Moudy, and Dorothy W. Hawley. *Anal. Chem.* **25**, 1369-73(1953) Sept.

The direct colorimetric determination of U, in the presence of moderate or large amounts of Fe, is not possible by other methods. By the 8-quinolinol method, U may be determined in the presence of 500 mg of Fe, 50 mg of Cu, 20 mg of Ni, or 20 mg of Co without prior separations. In conjunction with the hydrolytic separation by which U is separated from most of the colored ions, but not Fe, U may be determined colorimetrically, as a routine technique. With an ordinary Beckman spectrophotometer 10 μ g of uranium are easily determined. (auth)

6390

PREPARATION OF WATER SAMPLES FOR DEUTERIUM ANALYSIS IN THE MASS SPECTROMETER. Francis P. Chinard and Theodore Enns. *Anal. Chem.* **25**, 1413-14 (1953) Sept.

Samples of H_2O for D analysis in the mass spectrometer were sealed into individual glass sample tubes containing about 2 g of Zn dust. The tubes were then heated in a furnace at about 400°C for 30 min to reduce the H_2O . The procedure permits more numerous analyses to be made and reduces or eliminates certain of the sources of error inherent in the conventional Zn-reduction trains; it does not affect the memory effect arising from absorbed H_2O in the mass spectrometer. (J.A.G.)

6391

METHODS FOR ANALYSIS OF TITANIUM ALLOYS. Maurice Codell, Charles Clemency, George Norwitz, Allen Cherney, and James J. Mikula. *Anal. Chem.* **25**, 1432-49(1953) Oct.

Methods are proposed for determining Si, Ca, Al, Mo, P, and B in Ti alloys. Si is determined colorimetrically by the Mo blue method after most of the Ti has been hydrolyzed as a crystalline precipitate from a fluoboric acid solution by means of a new technique. The method is applicable to 0.005 to 1.5% Si. In determining Ca, the Ti is separated from the Ca by cupferron precipitation and a chloroform extraction. The Ca is precipitated as Ca sulfate from a methanol medium, and the Ca is weighed as $CaSO_4$ or determined nephelometrically as Ca stearate. The method is applicable to 0.005 to 0.3% Ca. In determining Al, a cupferron precipitation is made on an 0.02 g aliquot and the solution is filtered. The cupferron in the filtrate is destroyed by fuming with $HClO_4$, the $HClO_4$ is driven off, and the Al is determined colorimetrically with aluminon. The method is applicable to 0.01 to 0.4% Al. A method is proposed for determining 0.25 to 10% Mo in Mo-Ti alloys by precipitation as the sulfide from a $HF-H_2SO_4$ medium. In developing the procedure an exhaustive investigation was made of the factors involved in

obtaining quantitative precipitation of Mo sulfide. A polarographic method is proposed for determining Mo in Ti alloys that is applicable to the range of 0.003 to 5% Mo. In this method the Mo is extracted with ether from a $\text{HCl-H}_2\text{SO}_4$ solution, the ether is evaporated off, and the Mo is determined polarographically from a perchloric acid medium. The conditions for obtaining quantitative extraction of the Mo were investigated. P is determined colorimetrically by the Mo blue method after dissolving the sample in a mixture of Hf and HNO_3 , evaporating to fumes of H_2SO_4 , and complexing the Ni with NaF . The range of the method for P is 0.005 to 0.50%. In the method for B the sample is dissolved in H_2SO_4 , and the Ti and B are oxidized with H_2O_2 . The peroxide is destroyed by boiling in the presence of an Fe salt as a catalyst. The B is distilled as methyl borate, and the B is determined colorimetrically with dianthramide. The method is applicable to 0.0004 to 0.10% B. (auth)

6392

DETERMINATION OF SMALL AMOUNTS OF NIOBIUM AND TANTALUM USING RADIOISOTOPE TRACER TECHNIQUE. Thomas F. Boyd and Michael Galan. *Anal. Chem.* **25**, 1568-71 (1953) Oct.

Completeness of precipitation in the operations of a colorimetric method for the determination of Nb and Ta in austenitic steel was tested with Nb^{95} and Ta^{182} tracers. Precautions to be used in the analysis are indicated. (G.Y.)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

6393

THE THEORY OF THE NUMBER OF ELEMENTS IN A PERIOD OF THE SYSTEM OF D. I. MENDELEEV. V. M. Klechkovskii. *Zhur. Fiz. Khim.* **27**, 1251-5 (1953) Aug. (In Russian)

Electrons fill up the quantum levels successively from the quantum level with less value to the quantum level with a higher value of $n+1$, and from a subgroup with smaller n and larger l to a subgroup with greater n and smaller l . In each period of the system the filling of the S-level by electrons begins with the value $n+1$, and all levels, except S, are filled with a value of $n+1$ greater by a unit than the number of the period. The number of elements in each period is given by the expression $0.5(n+1)^2$ if n is odd and by $0.5(n+2)^2$ if n is even. (J.S.R.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6394

Cryogenic Lab., Ohio State Univ.
FORMATION, STABILITY AND CRYSTAL STRUCTURE OF SOLID SILICON MONOXIDE. Michael Hoch and Herrick L. Johnston. Feb. 27, 1953. 15p. (NP-4730; AD-994; TR-280-7)

The formation of solid SiO from a mixture of Si and SiO_2 , according to the reaction $\text{Si} + \text{SiO}_2 \rightarrow 2\text{SiO}$, was observed from x-ray-diffraction patterns taken at 1250 and 1300°C during various time intervals. At 1250°C no SiO is formed. At 1300°C the mixture of Si and SiO_2 was completely transformed into SiO , after about 9 hr of heating. The 3 x-ray-diffraction patterns taken during this 9-hr period show a decrease in intensity of the Si -diffraction lines and the appearance of a new set of diffraction lines, corresponding to those of SiO , the intensities of which increased during this period. The SiO_2 used was amorphous and did not crystallize even after prolonged heating. Since SiO , on slow cooling, disproportionates back to Si and SiO_2 , the SiO was rapidly quenched (from 1300 to 850°C in 2 sec), thereby resulting in a mixture of SiO_2 , SiO , and Si. This procedure enabled a diffraction pattern of SiO at 25°C to be obtained. The crystal structure and lattice constants of Si and SiO

were determined at 1300 and 25°C. Results showed that Si has the same body-centered lattice at 1300°C as at room temperature, with a lattice constant of $a = 5.445 \text{ \AA}$ at 1300°C and 5.413 $\text{\AA}$ at 25°C. The lattice of SiO was found to be cubic, the lattice constants at 1300 and 25°C being 7.135 $\text{\AA}$ and 7.09 $\text{\AA}$, respectively. (auth)

6395

Laboratory for Insulation Research, Mass. Inst. of Tech.
THE CRYSTAL STRUCTURE OF BARIUM TETRASULFIDE MONOHYDRATE. S. C. Abrahams. Sept. 1953. 28p. (NP-4903)

DEUTERIUM AND DEUTERIUM COMPOUNDS

6396

National Bureau of Standards
A CRITICAL REVIEW OF THE LITERATURE RELATING TO THE VAPOR PRESSURE OF AMMONIA AND TRI-DEUTEROAMMONIA. George T. Armstrong. June 30, 1953. 38p. (NBS-2626)

By comparison and critical evaluation of the vapor-pressure data of NH_3 , the triple point is found to be 195.46°K and 45.58 mm Hg; the boiling point, 239.78°K; the critical point, 405.6°K and 112.4 atm. $\text{Log}_{10} P(\text{mm}) = 9.98379 - 1627.22(1/T)$ represents the vapor pressure of solid NH_3 . $\text{Log}_{10} P(\text{mm}) = 9.95028 - 1473.17(1/T) - 0.0038603 T$ represents the vapor pressure of the liquid below 250°K. Smoothed values at one-degree intervals are used to represent the vapor pressure of NH_3 from 250°K to the critical point. The vapor-pressure data obtained since 1914 has a mean deviation of 0.75% from the equation for the solid, 0.3% from the equation for the liquid below 250°K, and 0.03% from the smoothed values for higher temperatures. In correlating the data from various sources, a comparison was made of temperature scales of the National Bureau of Standards, the Physikalisch Technische Reichsanstalt, and the Univ. of Calif. in the temperature range 150 to 240°K. After critical evaluation of the vapor-pressure data of ND_3 , the triple point is found to be 199.0°K and 48.22 mm; the boiling point, 242.26°K, and the critical temperature, 405.4°K. $T \text{ Log}_{10} P_D/P_H = -1.75 - 4513.7(1/T)$ represents the vapor-pressure ratio of ND_3 and NH_3 in the solid region. $T \text{ Log}_{10} P_D/P_H = 14.86 - 6731.9(1/T)$ represents the ratio in the liquid region. 67 references. (auth)

6397

ANOMALOUS D^+ AND OD^- ION MOBILITY IN HEAVY WATER. A. Gierer. Translated by J. A. E. Prochnow from *Z. Naturforsch.* **5a**, 581-9 (1950). Apr. 12, 1951. 17p. (AEC-tr-1688)

Measurements were made of the dependence of the conductivity of DCl , NaOD , and NaCl on the temperature in D_2O and mixtures of H_2O and D_2O . In D_2O , the equivalent conductivity with infinite dilution was determined by extrapolation in mixtures of H_2O and D_2O ; the deviation from the linear course with the mole fraction H_2O in D_2O was determined. The results of these measurements were compared with the expectations resulting from the theory of anomalously high mobility of H^+ and OH^- , or D^+ and OD^- ions. According to this comparison, there is a special migration mechanism of protons and deuterons over H_2 bridges, which is influenced characteristically by the anomalies of the water structure. The theory which reproduces the experiments for H^+ ions also is confirmed for D^+ ions. The experiments confirm the theoretical relationship of the mobility of D^+ and OD^- ions. The deviation of the extra mobility from the linearity of the mixtures of H_2O and D_2O can be reconciled with independently determined values, and their dependence on temperature can also be explained. (auth)

6398

MICROWAVE SPECTRUM OF HDO. D. W. Posener and M. W. P. Strandberg. *J. Chem. Phys.* **21**, 1401-2(1953) Aug.

Analysis of the HDO microwave spectrum was made, guided by the behavior of the frequencies calculated theoretically from infrared data on H₂O and D₂O. The frequencies of Q-branch transitions calculated in this manner bear a very simple relationship to those actually observed. The theoretical distortion parameters, as inferred by results obtained, are very close to the true values. The spectrum has been fitted by adjusting only the theoretical effective reciprocal moments of inertia. Parameters have been obtained for the HDO molecule. (J.A.G.)

FLUORINE AND FLUORINE COMPOUNDS

5399

Cryogenic Lab., Ohio State Univ.

HEAT CAPACITIES, LATENT HEATS AND ENTROPIES OF FLUORINE FROM 13° TO 85° K; HEATS OF TRANSITION, FUSION, VAPORIZATION AND VAPOR PRESSURES OF THE LIQUID. Jih-Heng Hu, David White, and Herrick L. Johnston. Apr. 20, 1953. 21p. (AD-10067; TR-283-23)

Heat capacities of F were measured from 14 to 85°K. A first-order transition was found at 45.55°K with heat of transition equal to 173.90 ± 0.04 cal/mole. The melting point of pure F was found to be 53.54°K, and the heat of fusion, 122.0 ± 0.5 cal/mole. The heat of vaporization at 84.71°K and 738 mm of Hg was found to be 1564 ± 0.98 ± 3 cal/mole. The vapor pressure of liquid F was measured between the m.p. and 90°K, and the data were fitted to the equation $\log P_{\text{mm}} = 7.08718 - 357.258/T - 1.3155 \times 10^{13}/T^8$. The normal b.p., calculated from this equation, is 85.02 ± 0.02°K. Thermodynamic functions of F have been computed from 0 to 85°K. The entropy in the ideal gas state at 85.02°K, from the calorimetric measurements, is 39.58 ± 0.16 eu. Values calculated from spectroscopic data, 39.56 ± 0.01 and 39.62 ± 0.02 eu, respectively, are in good agreement with the calorimetric value. (auth)

5400

Kedzie Chemical Lab., Michigan State Coll.

THE PHYSICAL PROPERTIES OF HALOGEN FLUORIDES. DIELECTRIC CONSTANTS OF LIQUID CHLORINE TRIFLUORIDE AND IODINE PENTAFLUORIDE. H. Bradford Thompson, John L. Speirs, and Max T. Rogers. [1953?] 4p. (AECU-2461)

ClF₃ was studied at 1 and 10 Mc in the temperature range 0 to 25°C; the results were found to fit the expression $E_t = 4.754 - 0.0187t$ to within ±0.02, where t is the temperature in °C. IF₅ was studied at 3, 5, 10, 15, 20, and 25 Mc in the temperature range of 12 to 32°C; the results fit the expression $E_t = 46.22 - 0.388t$ to within ±0.1. The dielectric constants at 25°C are 4.27 for ClF₃ and 36.5 for IF₅. (J.A.G.)

6401

Maine Univ.

INVESTIGATE PHYSICAL AND PHYSICO-CHEMICAL PROPERTIES OF MIXTURES OF HYDROCARBONS AND FLUOROCARBONS. QUARTERLY PROGRESS REPORT, OCTOBER 1, 1952 - JANUARY 2, 1953. Robert D. Dunlap. Feb. 3, 1953. 7p. (NP-4779; AD-6749; Quarterly Progress Report 4)

The critical unmixing temperatures of fluorocarbon-hydrocarbon systems and the volume change attending their mixing are examined theoretically. An equation has been derived for the energy of mixing which takes into account the increase in potential energy of the mixture due to expansion. Critical unmixing temperatures have been calculated by means of this equation, and the results are compared with experiment. (J.A.G.)

6402

EVALUATION OF ORGANIC FLUORINE COMPOUNDS FOR USE IN MILITARY AIRCRAFT. Harold Rosenberg and J. C. Mosteller. *Ind. Eng. Chem.* **45**, 2283-6(1953) Oct.

Applications of organic fluorine compounds in new high-speed aircraft and guided missiles are discussed. This includes use of F-containing materials as fire-extinguishing agents, acid-resistant coatings and protective materials, nonflammable hydraulic fluids and lubricants, rubberlike materials, components of electronic equipment, and fungicides. (J.A.G.)

GRAPHITE

6403

CARBON AND GRAPHITE. W. M. Gaylord. *Ind. Eng. Chem.* **45**, 2182-4(1953) Oct. (cf. NSA-5-6677)

This review concerns applications and physical properties of impervious graphite which have been published in the last 2 years. 39 references. (J.A.G.)

6404

COMBUSTION RATE OF ARTIFICIAL GRAPHITES FROM 700°C TO 2000°C IN AIR. Jun Okada and Tatsuo Ikegawa. *J. Appl. Phys.* **24**, 1249-50(1953) Sept.

Specimens of artificial graphite 10 mm in diam. and 100 mm in length were held horizontally between two artificial graphite electrodes and heated quickly by electric current from 700 to 2000°C in 1 atm of air at room temperature. The temperature distribution along the specimen, measured by an optical pyrometer, was comparatively uniform except for the parts of 2 cm length from both ends of the specimen. After 15 to 20 min at the highest temperature, the specimen was connectively cooled in an extensive air space, the ashes were cleaned off, and weight loss was determined for the middle 60 mm length. The combustion rate k , expressed as weight loss per unit apparent surface area and unit time, was calculated, and a typical plot of $\log 10^2 k$ vs $1/T$ is presented. Results are compared with those of previous investigators. (L.M.T.)

6405

THE ADSORPTION OF ARGON ON GRAPHITE. A. D. Crowell and D. M. Young. *Trans. Faraday Soc.* **49**, 1081-5 (1953) Sept.

Adsorption isotherms have been measured for argon on graphite between 80 and 90°K and in the pressure range 0.1 to 50 mm, and heats of adsorption have been calculated. The heats of adsorption at 0°K of an isolated argon atom adsorbed over three different positions on the basal plane of graphite have been evaluated approximately by numerical summation. The results indicate that the adsorbed argon film is nonlocalized, except at low surface coverage. (auth)

6406

THE ADSORPTION OF *n*-HEPTANE ON SOLIDS AT LOW PRESSURE. D. M. Young, R. A. Beebe, and H. Bienes. *Trans. Faraday Soc.* **49**, 1086-9(1953) Sept.

Adsorption isotherms have been measured for *n*-heptane on graphite, ferric oxide, and reduced Ag at low pressures. The isotherms confirm the conclusions of Smith (*J. Am. Chem. Soc.* **74**, 3477(1952)) in that, unlike those of previous investigators, they provide no evidence of first-order phase transitions in the above systems. (auth)

LABORATORIES AND EQUIPMENT

6407

AN EFFECTIVE SAFETY PIPETTE. F. Lee Rodkey. *Science* **118**, 488-9(1953) Oct. 23.

A very simple and easily constructed piece of apparatus that eliminates the possibility of oral or cutaneous contamination of the operator when transferring toxic, radioactive, or hazardous liquids, yet maintains complete and accurate delivery control, is described. Operation is con-

trolled by a rubber bulb sealed to a side arm of the pipet and closed by a glass-bead valve. (G. Y.)

MOLECULAR STRUCTURE

5405

Naval Research Lab., Univ. of Wis.

SURVEY OF THE EQUATION OF STATE AND TRANSPORT PROPERTIES OF GASES AND LIQUIDS. R. B. Bird, J. O. Hirschfelder and C. F. Curtiss. Nov. 15, 1952. 73p. (CM-758; AD-5522)

RADIATION CHEMISTRY

6409

Rensselaer Polytechnic Inst.

DECOMPOSITION OF CARBON DIOXIDE BY IONIZING RADIATION. SEMI-ANNUAL REPORT. S. Dondes and A. J. Hogan. July 1, 1953. 30p. (SO-3254)

The gaseous reaction of ozone and CO was investigated at 35, 180, and 258°C. The results indicate that the conclusions drawn from the earlier work at 100°C are substantially correct at the other temperatures. It was established that the formation of CO₂ from CO and ozone is a secondary process, following the normal thermal decomposition of the ozone. Photochemical ultraviolet irradiation between 3000 and 3800 Å of CO and NO₂ (used as an inhibitor) at 180 and 258°C produces no CO₂. The decomposition of CO₂ by irradiation with Rn at room temperature indicates that the decomposition is extremely small, correlating with results published in the literature. The products of the decomposition can be recombined under the influence of a Tesla coil discharge to indicate the presence of CO and O₂. The decomposition of CO₂ can be increased by irradiating with Rn at the temperature of liquid N. A Sr⁹⁰-Y⁹⁰ source for the β irradiation of CO₂ was prepared. The reaction vessel was designed and constructed and is also described. (auth)

6410

SUBSTITUTION REACTIONS OF HALOGENS ACTIVATED BY NEUTRON CAPTURE. G. Gavoret. *J. chim. phys.* **50**, 434(1953) July-Aug. (In French)

In a previous study (NSA 7-4079) on competitive aromatic substitution by Br⁸², the ratios K_X/K_H of the reaction velocities of monosubstituted benzene relative to benzene were measured in equimolecular mixtures. In order to verify that the ratio thus determined is independent of the relative concentration of the two constituents, the mole fractions of nitrobenzene-benzene and toluene-benzene mixtures were varied over a wide range. The resulting ratios were then adjusted to equimolarity. Constant ratios K_{NO₂}/K_H = 0.22 and K_{CH₃}/K_H = 1.45 were found, in contrast to the respective values of 0.26 and 0.89 reported in the previous communication. (G.Y.)

RADIATION EFFECTS

6411

POLYMERIZATION AND DEPOLYMERIZATION BY X RAYS; EFFECTS OF PROTECTIVE AGENTS. P. Alexander and M. Fox. *J. chim. phys.* **50**, 415-22(1953) June. (In French)

Polymethacrylic acid in aqueous solution is degraded by x rays in the presence of O₂, and evidence is presented showing that the radical HO₂ is responsible for the breaking of the C-C bond in the polymer chain. Experiences with a synthetic polyphosphate show that the bond P-O is not easily broken by the radicals produced in the water by ionizing radiations. Amines, sulfides, and the derivatives of indole inhibit the degradation. These substances also reduce the toxicity of x rays in mammals if they are administered before irradiation. There is a satisfying correlation between

their effectiveness *in vivo* and *in vitro*. The polymerization of polymethacrylic acid in aqueous solution, induced by x rays, has been studied, and it was found that certain of the protective agents, but not all, reduce the quantity of polymer formed. The molecular weight indicates that the reduction in yield, caused by the substance added, is caused in some cases by a termination of the chain; in other cases it is caused by the fixation of the primary OH radical. It is concluded that, in a given series of substances, the protective action and the reactivity of the OH radical are not parallel. The experiences of others with the degradation of the polymer shows that the biological activity follows the rate of reaction with the HO₂ radicals, and from that fact there is a tendency to believe that the radicals play an important role in the production in mammals of biological changes leading to death after irradiation. (tr-auth)

6412

SECONDARY DEVELOPMENT OF MOLECULES WITH A PHENOLIC RADICAL FOLLOWING THEIR IRRADIATION WITH X RAYS. Jean Loiseleur and Muguet Sauvage. *Compt. rend.* **237**, 204-6(1953) July 15. (In French)

A considerable increase in optical density of aqueous solutions of gallic acid, adrenaline, tannin, and tyrosine was observed following their irradiation, in the presence of O, with up to 750,000 r of Be-filtered W x rays. Traces of Cu catalyze this secondary reaction. (G.Y.)

6413

EFFECT OF REDUCING AGENTS ON THE LATENT EFFECT OF X RAYS IN VITRO. Jean Loiseleur, Liliane Catinot, and Pierre Morenne. *Compt. rend.* **237**, 410-12 (1953) Aug. 3. (In French)

The post-irradiation increase in the optical density of solutions of gallic acid, tannin, adrenaline, and tyrosine (molecules containing phenol radicals) is decreased by the addition, immediately after the x irradiation, of Na hypophosphite, thiourea, cysteine, or ascorbic acid. The action of the reducing agent is dependent on the pH, independent of the x-ray dose (the experiments were limited to 750,000 r), and directly related to its concentration. (G.Y.)

6414

CHEMICAL SYNTHESSES FOLLOWING THE ACTION OF X RAYS. Antoine Lacassagne and Jean Loiseleur. *Compt. rend.* **237**, 417-19(1953) Aug. 10. (In French)

Observation of the formation of dyes following the x irradiation of molecules having phenol radicals has prompted a study of the mode of action of radiation in molecular synthesis and degradation. The effects of x rays are shown to be in inverse relation to the mass of the irradiated molecule: dissociation of complex and high-molecular-weight molecules, combination of simple, low-molecular-weight molecules. (G.Y.)

6415

CHEMICAL SYNTHESSES FOLLOWING THE ACTION OF PHYSICAL PEROXIDIZING AGENTS (X, ULTRAVIOLET, OR ULTRASONIC RADIATIONS). Jean Loiseleur. *Compt. rend.* **237**, 461-4(1953) Aug. 17. (In French)

Organic molecules of low molecular weight subjected to the action of a peroxidizing agent, such as x rays, ultraviolet light, or ultrasound, are first transformed into peroxides, which, because of their instability, can produce chemical syntheses by condensation with another molecule. The effect is illustrated by x irradiation of dimethyl-p-phenylenediamine and α-naphthol or m-toluylenediamine to form indophenol blue and toluylene blue, respectively, and ultrasonic irradiation of p-phenylenediamine and H₂S to form Lauth violet. (G.Y.)

6416

HYDROGEN PEROXIDE FORMATION IN THE OXIDATION OF DILUTE AQUEOUS SOLUTIONS OF FERROUS SUL-

PHATE BY IONIZING RADIATIONS. F. S. Dainton and H. C. Sutton. *Trans. Faraday Soc.* **49**, 1011-25(1953) Sept.

The oxidation by ionizing radiation of ferrous sulfate in either aerated or air-free aqueous solutions of concentrations less than $10^{-4}M$ is characterized by a measurable post-irradiation process. By investigation of its kinetics and by other means, this reaction is shown to be the oxidation of ferrous sulfate by H_2O_2 formed during the irradiation. In air-free solution the H_2O_2 is entirely "molecular" in origin; in aerated solution this "molecular" H_2O_2 is augmented by the H_2O_2 formed by the reduction of HO_2 radicals by Fe^{++} ions. The "molecular" yield of H_2O_2 ($G_{H_2O_2}^M$) is significantly larger than $G_{H_2}^M$ and is unaffected by experimental variables other than the concentration of ferrous ions, very large increases of which produce very slight decreases in $G_{H_2O_2}^M$. These and other effects, including the oxidation-dose curve, are discussed theoretically. (auth)

SEPARATION PROCEDURES

6417

Knolls Atomic Power Lab.

THE "PUMP-MIX" MIXER SETTLER. A NEW LIQUID-LIQUID EXTRACTOR. B. V. Coplan, J. K. Davidson, and E. L. Zebroski. [1953] 26p. (AECU-2639)

The design and operating characteristics of a new type of mixer settler for liquid-liquid countercurrent extraction are described. The design is novel in that interface control is achieved without instrumentation. The stage arrangement is compact and, compared to usual contacting equipment, requires less height. This has advantages for a cascade of contactors operating in series. The effects of impeller speed and blade arrangement on the mixing intensity, which in turn determines the stage efficiency, are shown. The capacity of the unit was found to be determined by the disengaging time and emulsion forming characteristics of the system under test rather than by the pumping capacity of the impeller. High stage efficiencies were obtained over the entire flow range of the unit. Using the system methyl isobutyl ketone-water-acetic acid, runs were made extracting acetic acid from water into the ketone in a ten-stage pilot-plant unit. As calculated by the McCabe-Thiele method, the number of theoretical stages corresponded to the number of actual stages used, for an average stage efficiency of 100%. (auth)

6418

Sterling Chemistry Lab., Yale Univ.

ADSORPTION STUDIES ON CLAY MINERALS. 4. THE SYSTEM MONTMORILLONITE-CESIUM-POTASSIUM. Joseph A. Faucher and Henry C. Thomas. [1953] 17p. (BNL-1539)

The ion-exchange equilibria between a montmorillonite clay and K-Cs from chloride solutions were studied by chromatographic and other methods. The results are summarized in terms of equilibrium constants and activity coefficients for the mixed clay phase. A tentative discussion is given of the rate of the exchange process, particularly as it affects the behavior of the chromatographic columns. (For preceding report in series see BNL-1538.) (auth)

SORPTION PHENOMENA

6419

Physical Electronics Lab., Brown Univ.

CONTINUATION OF THE STUDY OF ADSORPTION OF GASES ON METAL SURFACES USING THE RADIOACTIVE TRACER TECHNIQUE. John A. Dillon, Jr. and H. E. Farnsworth. [Nov. 1952] 4p. (NP-4817; AD-3892; Technical Report 10)

A study is made of the adsorption of gaseous CO_2 on polycrystalline Ni samples. Measurements were made using

C^{14} as a tracer. Results showed that the outgassing time during crystal preparation had an important effect on the amount of gas adsorbed. Outgassing at high temperatures and the use of a large surface area improved the reproducibility of the data. (K.S.)

SPECTROSCOPY

6420

Spectroscopy Lab., Ill. Inst. of Tech.

SUBSTITUTED METHANES. 18. VIBRATIONAL SPECTRA OF $C^{13}H_3I$; TECHNICAL REPORT [ON] MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Richard B. Bernstein, Forrest F. Cleveland, and Fred L. Voelz. Aug. 14, 1953. 18p. (NP-4772; Technical Report 16)

Raman (liquid) and infrared (liquid and gas, with KBr and NaCl prisms) spectra have been obtained for 2 mixtures of $C^{13}H_3I$ (9.3 and 61 at. %) and $C^{12}H_3I$, and from these the vibrational spectrum of $C^{13}H_3I$ has been deduced. In the Raman spectrum, only $\nu_3(a_1)$ (the C-I stretching frequency) could be resolved from the $C^{12}H_3I$ lines; the isotopic shift was $-17.7 \pm 0.5 \text{ cm}^{-1}$. In the infrared spectrum (gas), 5 isotopic shifts were obtained; they were: $\nu_1(a_1) -10 \pm 3$, $\nu_2(a_1) -5.5 \pm 1.0$, $\nu_3(a_1) -16.1 \pm 1.0$, $\nu_8(e) -4.4 \pm 0.6$, and $\nu_6(e) -3.7 \pm 0.3 \text{ cm}^{-1}$. For the remaining fundamental, $\nu_4(e)$, the shift was obtained by use of the Redlich-Teller product rule; the value was $-9.4 \pm 2.3 \text{ cm}^{-1}$. Analysis of the perpendicular bands yielded, with the aid of microwave data, values of the rotational constants, Coriolis interaction constants, and band origins for the $\nu_6(e)$, $\nu_8(e)$, and $\nu_4(e)$ bands of $C^{13}H_3I$ and $C^{12}H_3I$, though the values for the $\nu_4(e)$ band of $C^{13}H_3I$ are only estimated values since the sub-bands were not resolved in this case. (auth)

6421

American Spectrographic Labs.

SPECTROCHEMICAL ANALYSIS OF SILICATES AND OXIDES; QUARTERLY PROGRESS REPORT, DECEMBER 1952-FEBRUARY 1953, INCL. Charles E. Harvey. [nd] 13p. (NP-4803; AD-9864; Quarterly Progress Report 5)

The spectral sensitivity limits for traces of Cu, Si, Mg, Sb, As, Pb, Bi, Sn, Zn, Cd, Ag, Ga, Al, Fe, Mn, and Ni in Ge were determined. Non-metallic samples containing Ge were converted to the oxide and the impurities were checked semi-quantitatively. (J.S.R.)

SYNTHESES

6422

New York Univ. Coll. of Medicine

THE BIOSYNTHESIS OF NUCLEIC ACIDS IN THE LIVERS OF ADULT MICE. Jacques R. Fresco, New York University College of Medicine and Alfred Marshak, United States Public Health Service. [nd] 30p. (AECU-2681)

Uniformly labeled C^{14} -purines and pyrimidines of high specific activity were prepared by biosynthesis. The course of incorporation and disappearance of tracer from the purines of several nucleotide and polynucleotide fractions of the livers of adult mice was determined during the first 24 hr following the administration of single trace doses of uniformly labeled C^{14} -adenine. Adenine was incorporated very rapidly into the acid-soluble adenine and nuclear ribonucleic acid adenine components and more slowly into the cytoplasmic ribonucleic acid adenine components. It was also converted to polynucleotide guanine. The data indicate approximate renewal rates of 12 and 24 hr for the nuclear and cytoplasmic ribonucleic acids, respectively. The incorporation of adenine into the desoxyribonucleic acid purines was significant but of a low order of magnitude in comparison to that into the ribonucleic acids purines. Some of these observations are discussed with reference to

mechanisms of biosynthesis and rates of turnover of polynucleotides. (auth)

5423

Worcester Foundation for Experimental Biology
THE METABOLISM OF PREGNANE-17 α ,21-DIOL-3,20-DIONE AND PREGNANE-17 α ,21-DIOL-3,11,20-TRIONE IN VIVO. Frank Ungar, John W. Davis, Harris Rosenkrantz, and Ralph I. Dorfman. Worcester Foundation for Experimental Biology and Boston Univ. [1953] 20p. (AECU-2683)

The isolation of urinary 17-ketosteroids following the administration of pregnane-17 α ,21-diol-3,20-dione (dihydro S) and pregnane-17 α ,21-diol-3,11,20-trione (dihydro E) to two female patients is reported. The role of dihydro S as a possible intermediate in the metabolism of 17 α -hydroxy-11-desoxycorticosterone is discussed. (C.H.)

6424

MECHANISM OF SYNTHESIS OF AMINO ACIDS IN LIVER. M. G. Kritzman [Kritzman] and K. V. Druzhinina [Drujinina]. Translated from Doklady Akad. Nauk S.S.S.R. 69, 569-72(1949). 10p. (UCRL-Trans-52)

TRANSURANIC ELEMENTS AND COMPOUNDS

5425

Los Alamos Scientific Lab.

PREPARATION, IDENTIFICATION, AND CRYSTAL STRUCTURE OF A PENTAVALENT AMERICIUM COMPOUND, KAmO₂F₂. L. B. Asprey, F. H. Ellinger, and W. H. Zachariasen. Decl. Aug. 5, 1953. 12p. (AECD-3554)

A compound that is shown to be KAmO₂F₂ is prepared by the addition of a saturated solution of KF to an acid solution of pentavalent Am. The substance is found to be rhombohedral with one molecule in a unit cell of dimensions $a = 6.78 \text{ \AA}$, $\alpha = 36.25^\circ$. The space group is $R\bar{3}m$, and the atomic positions are: 1 Am in (0,0,0), 1 K in ($\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$), 2 O in $\pm(u,u,u)$ with $u = 0.102$, 2 F in $\pm(v,v,v)$ with $v = 0.356$. The structure contains [AmO₂]⁺ radicals and is built up of (AmO₂F₂)⁻ layers held together by K ions. The structure type is that of CaUO₂O₂. (auth)

TRITIUM AND TRITIUM COMPOUNDS

5426

THE OXIDATION OF MOLECULAR TRITIUM IN MAMMALS. Grant N. Smith, R. J. Emerson, L. A. Temple, and T. W. Galbraith. Arch. Biochem. and Biophys. 46, 22-30(1953) Sept.

Bacteria isolated from the intestinal contents from rats have been found to fix significant quantities of molecular tritium. The possibility that bacteria were the principal agent in the fixation of tritium within the animal body was investigated. Oxidation of tritium by tissue homogenates revealed that oxidation occurred with homogenates prepared from the spleen and intestines. Fixation by the intestinal homogenates was undoubtedly due to bacterial action. A decrease in the bacterial flora of intact animals by either evisceration or treatment with antibiotics reduced the total quantity of tritium oxidized. These results indicate that the bacterial content may be the principal agent in the oxidation of tritium within the animal body. (auth)

6427

ESTIMATING THE TRITIUM CONTENT OF TRITIATED WATER. Wilmer A. Jenkins. Anal. Chem. 25, 1477-80 (1953) Oct.

Present methods for the radioactive assay of tritiated water are somewhat laborious and require specialized equipment. For this reason, a simpler method, involving the use of a windowless flow counter, would be desirable. It was found that a method, based on measuring the activity

of solid NH₄Cl that had been rendered radioactive by exchange with tritiated water, could be developed to give reproducible results. The accuracy of the method is at present limited to 15%. In its present state, this method should be particularly useful for the rapid determination of the approximate activity of tritiated water samples in experiments where an accurate figure for the activity is not necessary. (auth)

URANIUM AND URANIUM COMPOUNDS

5428

Carbide and Carbon Chemicals Co. (Y-12)
THE DETERMINATION OF ADSORBED MOISTURE ON URANIUM AND URANIUM OXIDE; A NEW METHOD FOR MOISTURE DETERMINATIONS. James O. Hibbits and Donald Zucker. Apr. 22, 1953. Decl. June 17, 1953. 18p. (AECD-3535; Y-959)

A method is described for determining moisture on U and U oxides. This method should also be applicable to solid samples which, when heated, do not decompose to form H₂O or liberate a substance which will react with Fischer's reagent. The method should be especially applicable to samples which are insoluble in alcohol or Karl Fischer reagent under normal titration conditions, or which will themselves react with the reagent. The amount of moisture on uranium and uranium oxide was found to be 0.02% except when the oxide source was uranyl sulfate. In this case, the moisture content was found to be 0.1%. Modifications of the procedure and apparatus are presented for improving the accuracy and shortening the time necessary for the determination. (auth)

6429

Carbide and Carbon Chemicals Co. (Y-12)
FURTHER INVESTIGATION OF XERORADIOGRAPHY FOR RADIOGRAPHIC INSPECTION OF URANIUM. R. E. Cofield. Feb. 1, 1953. Decl. Aug. 21, 1953. 16p. (AECD-3579; Y-979)

An investigation with experimental equipment and techniques has shown that xeroradiography is suitable for non-destructive testing of U with radiation from a 1000-kv x-ray unit or from a Co⁶⁰ source. With x rays, resolution and sensitivity of 2% has been obtained through 1-in. thicknesses of U, radiographically equivalent to about 5 in. of steel. Resolution of 4% and penetrometer sensitivity of 2% is reported for U thicknesses of 1 in. with γ rays. A more satisfactory powder cloud developer has been employed, and exposure data have been collected in exposure charts for U thicknesses of 0.125 to 1 in. with x and γ rays for two types of xeroradiographic plates. Extensive development and control of plate manufacturing processes, beyond the scope of this investigation, are needed to eliminate plate defects in images. Actual use of the technique for high-energy radiography has been shown to be dependent upon the production of plates with uniform surfaces and electrical properties. (auth)

6430

Mound Lab.

THE SURFACE TENSION OF AQUEOUS URANYL SULFATE SOLUTIONS BETWEEN 20° AND 75°C. M. K. Barnett and J. Jegart. Feb. 15, 1953. Decl. Sept. 8, 1953. 10p. (AECD-3581; MLM-815)

The surface tension of aqueous UO₂SO₄ solutions, ranging in concentration from 0.175 to 2.340 molal, has been measured at 20, 30, 45, 60, and 75°C. The surface tension increases continually with increasing temperature, becoming, in the most concentrated solutions, about 6% greater than that for water at the same temperature. The effect of concentration is approximately independent of temperature. The temperature coefficient of surface

tension is nearly the same for all solutions and approximates that for pure water. (auth)

6431

Los Alamos Scientific Lab.

A NEW FORM OF URANIUM HYDRIDE. R. N. R. Mulford, F. H. Ellinger, and W. H. Zachariasen. [1953] 5p. (AECU-2700)

A new crystal form of U hydride, believed to be an alternate structure of UH_3 , has been discovered. It was suggested that this new compound be called α UH_3 and the common form β UH_3 . X-ray studies of UH_3 showed that the extra lines produced by α UH_3 could be attributed to a diffraction pattern from a cubic cell with $a_0 = 4.160 \pm 0.001\text{\AA}$. It was found that mixtures of this new crystal form with ordinary UH_3 could be produced by allowing H to react with powdered U at low temperatures and that, roughly, the percentage of the new crystal form was higher the lower the temperature of reaction. Alpha UH_3 appears to be stable with respect to β UH_3 at 100°C but transforms to β UH_3 at 250°C . The reverse transformation, however, from β to α UH_3 apparently can not be effected in a reasonable time. It is shown that, regardless of the proportion of α and β , the composition is always very close to $\text{UH}_{3.00}$, thus providing chemical evidence that the α form has the composition UH_3 , since the composition of the β form has been previously established as UH_3 . It was concluded that the crystal structure of α UH_3 is simple cubic with $a_0 = 4.160 \pm 0.001\text{\AA}$ and with two molecules/unit cell. The space group is $\text{Pm}\bar{3}\text{n}$, and the atomic positions are 2 U in $(0, 0, 0)$ $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ and 6 H in $(\frac{1}{4}, 0, \frac{1}{4})$ $(\frac{1}{4}, \frac{1}{4}, 0)$ $(0, \frac{1}{2}, \frac{1}{4})$. The interatomic distances are exactly the same as in the known form of UH_3 . (J.A.G.)

6432

Technical Information Service, AEC

URANIUM AND ITS COMPOUNDS: A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Robert E. Allen, Comp. June 30, 1953. (TID-3041)

This bibliography contains 838 annotated references to unclassified literature on U and its compounds. References included in this compilation cover the period from January 1951 to May 1953 and were taken entirely from Nuclear Science Abstracts and Chemical Abstracts. This compilation is a supplement to "Uranium and Its Compounds" (K-295; Part 2) by Fred E. Croxton. (auth)

6433

CONTRIBUTIONS TO THE SYSTEMATIC STUDY OF SPECIES. XLI. ON URANIUM OXIDES. [Beiträge zur Systematischen Verwandtschaftslehre. XLI. Über Uranoxyde]. Wilhelm Biltz and Helmut Müller. Translated from Z. Anorg. u. Allgem. Chem. **163**, 257-96(1927). 68p. (UCRL-Trans-43)

The results of a systematic study on the preparation, analysis, decomposition, molecular volume, color, and crystal structure of UO_2 , UO_3 , and U_3O_8 are summarized. The study was made at Clausthal and Hanover over the period 1920 to 1927. (L.M.T.)

6434

COLORIMETRIC DETERMINATION OF URANIUM WITH DIBENZOYL METHANE. John H. Yoe, Fritz Will, III, and Robert A. Black. Anal. Chem. **25**, 1200-04(1953) Aug.

The purpose of this investigation was to make a critical study of the reaction of dibenzoylmethane with U(VI) and to develop a sensitive colorimetric method for its determination. A yellow complex forms instantaneously and has a maximum absorbance at $395\text{ m}\mu$. The optimum pH is 6.5 to 8.5 and the mole ratio of reagent to UO_2^{++} is 2 to 1. The color reaction conforms to Beer's law and has a practical sensitivity of 0.05 ppm of U when absorbance measurements are made in 1.00-cm cells. The tolerance of the colored complex to many diverse ions has been established.

A separation of U from interfering ions is accomplished by ether extraction of uranyl nitrate. The procedure should be useful where there is need for the determination of small amounts of U, especially in trace quantities. (auth)

6435

RECENT WORK ON THE CHEMISTRY OF URANIUM OXIDES. M. J. S. Anderson. Bull. soc. chim. France **9**, 781-8(1953) Sept. (In French)

Recent work done at Harwell on U oxides is described. The kinetics and mechanism of the oxidation of UO_2 to U_3O_8 are discussed. X-ray studies of the oxidation show the formation of a β phase in UO_2 with composition U_4O_9 , indicating the presence of interstitial O atoms. When the β phase is heated, a third phase appears. The change in the x-ray profile is diagrammed. The mechanism of oxidation displays three processes: (1) the isotherm of O adsorption at -180° upon a clean surface of UO_2 is not the same as that on a degassed or oxidized surface; (2) at temperatures higher than -140° the quantity of O found on the surface increases logarithmically with time; and (3) above 50° the oxidation follows a parabolic law. Although CO_2 absorbs only slowly on the surface of UO_2 , H_2 is absorbed readily. Phase diagrams of the oxidation of the mixed crystals $\text{UO}_2\text{-ThO}_2$, $\text{UO}_2\text{-CaO}$, $\text{UO}_2\text{-Y}_2\text{O}_3$, MgO-UO_2 , and CaUO_4 are given. (J.S.R.)

6436

CONSIDERATION OF THE URANIUM OXIDES BETWEEN UO_2 AND U_3O_8 . M. P. Perio. Bull. soc. chim. France **9**, 840-1(1953) Sept. (In French)

To the two quadratic oxides with $c/a > 1$ known between $\text{UO}_{2.30}$ and $\text{UO}_{2.40}$ is added a third with $c/a = 1.010$. The relationship between the stabilities of the oxides is discussed. The Anderson model of UO_2 oxidation appears to be correct. The region of the metastable cubic form extends to $\text{UO}_{2.60}$ at least. (J.S.R.)

6437

BINARY MIXTURES OF UO_2 AND OTHER OXIDES. Leo F. Epstein and W. H. Howland. J. Am. Ceram. Soc. **36**, 334-5 (1953) Oct.

The phase diagrams of the binary systems containing UO_2 and the oxides MgO , Al_2O_3 , and BeO have been constructed using (1) the laws of ideal solutions and (2) the approximation that the entropy of fusion of polyatomic molecules is NR , where N is the number of atoms per molecule. Reasonable values of the eutectic composition and temperature and satisfactory agreement with experiment have been obtained. (auth)

6438

URANIUM OXIDE PHASE EQUILIBRIUM SYSTEMS: I. $\text{UO}_2\text{-Al}_2\text{O}_3$. W. A. Lambertson and M. H. Mueller. J. Am. Ceram. Soc. **36**, 329-31(1953) Oct. (cf. NSA 6-3772)

The $\text{UO}_2\text{-Al}_2\text{O}_3$ phase-equilibrium system was found to contain no new compounds or solid solutions. UO_2 melted at $2878 \pm 22^\circ\text{C}$, and Al_2O_3 melted at $2034 \pm 16^\circ\text{C}$. The eutectic temperature was approximately 1930°C . There is an indication that two immiscible liquids formed above the eutectic temperature between 53 and 74 mole % Al_2O_3 . (auth)

6439

URANIUM OXIDE PHASE EQUILIBRIUM SYSTEMS: II. $\text{UO}_2\text{-MgO}$. W. A. Lambertson and M. H. Mueller. J. Am. Ceram. Soc. **36**, 332-4(1953) Oct.

A slight oxidation of UO_2 by MgO was found to occur at high temperatures although no compounds or solid solution were detected. The eutectic was between 70 and 80% MgO at about 2100°C . (auth)

6440

CRYOSCOPY IN MOLTEN CRYOLITE. Pierre Mergault. Compt. rend. **237**, 485-7(1953) Aug. 31. (In French)

Freezing-point-lowering curves for pure U_3O_8 and for the mixture $2\text{UO}_3 + \text{UO}_2$ are sensibly the same, indicating that U_3O_8 dissociates into $2\text{UO}_3 + \text{UO}_2$. $\text{UO}_2 \rightarrow 2\text{O}^{--} + \text{U}^{+4}$. An x-ray powder diffraction study of solutions of U_3O_8 in cryolite, after centrifugal separation in methylene iodide, indicates that some of the UO_3 is reduced to UO_2 , as suggested by the cryoscopic depression of ~ 5.3 rather than 5. Similar studies on several titanates, tungstates, Co_3O_4 , and chromite ($\text{Cr}_2\text{O}_3 \cdot \text{FeO}$) also are reported. (G.Y.)

WASTE DISPOSAL

6441

Los Alamos Scientific Lab.

ACTIVATED SLUDGE TREATMENT OF A MIXTURE OF RADIOACTIVE LAUNDRY WASTE AND SANITARY SEWAGE. Leo M. Reading, Everett R. Mathews, C. W. Christenson, and J. F. Newell. [1953?] 11p. (AECU-2671)

The activated-sludge process was found to be satisfactory for the treatment of a mixture of 15% radioactive waste from the Los Alamos industrial laundry and 85% settled sewage. Both Pu and organic matter removals were excellent under the experimental conditions employed. The process is described, and experimental results obtained are discussed. (C.H.)

ENGINEERING

6442

Battelle Memorial Inst.

EMPIRICAL EVALUATION OF THE PROPERTIES OF STEAM AT ELEVATED TEMPERATURES AND PRESSURES. A. W. Lemmon, Jr., D. J. Daniels, D. E. Sparrow, C. J. Geankoplis, J. J. Ward, and J. W. Clegg. Aug. 25, 1953. 64p. (BMI-858)

This correlational study of the properties of steam, experimentally determined by others, at pressures and temperatures above the critical point was made because of the increasing interest in this region. Specific volume, enthalpy, specific heat, viscosity, and thermal conductivity were studied at temperatures and pressures up to 1600°F and 21,000 psia. Final results have been tabulated and plotted on graphs. Experimental data, particularly those from obscure or foreign sources, have been tabulated for the convenience of the reader. Lack of experimental data was noted for specific volume in the region from 1000 to 10,000 psia and 1000 to 1600°F , and in the region from 10,000 to 21,000 psia and 700 to 1600°F . Thermal-conductivity and viscosity data are lacking in the region above 4000 psia and 1000°F . A complete bibliography is given. (auth)

6443

Cornell Univ.

COLUMN STRENGTH OF H-SECTIONS AND SQUARE TUBES IN POSTBUCKLING RANGE OF COMPONENT PLATES. P. P. Bijlaard and G. O. Fisher. Aug. 1953. 106p. (NACA-TN-2994)

The column-buckling stress in the range where the component plates have buckled is calculated by the method of split rigidities. For the elastic range simple formulas are derived which express the column-buckling stress in terms of the Euler buckling stress of the column, the plate or local buckling stress, and the local buckling stress for a higher mode of buckling. For the plastic range a Johnson parabola is proposed which, in the buckling-stress-slenderness diagram, is tangent to the curve for the elastic column-buckling stress in the postbuckling range. Also the

case of initially crooked columns is considered. Tests were carried out for a considerable range of slenderness ratios on three H-sections and two square tube sections. The experimental ultimate buckling stresses are in excellent agreement with those predicted by the theory. (auth)

6444

A NEW TYPE OF HELIUM LIQUEFIER. H. M. Long and F. E. Simon. *Nature* 172, 581(1953) Sept. 26.

A He liquefier in which the conventional cylinder and piston of the expansion engine are replaced by an elastic brass bellows has operated satisfactorily for 7 months. The bellows dimensions are 7.7 cm OD, 4 cm ID, 5.4 cm length with 15 convolutions. With the engine normally running at 2 to 3 cps, the life of the bellows under the present operating conditions of 5.5 atm inlet pressure and the very considerable stroke of 2.7 cm is about 5×10^5 cycles. The liquefier produces 0.4 l of liquid He per hour while consuming 1.2 l of liquid air. This rate is not optimal because of heat leaks and inefficiency in the heat exchangers. (G.Y.)

HEAT TRANSFER AND FLUID FLOW

6445

Cornell Aeronautical Lab., Inc.

THREE-DIMENSIONAL LIQUID ANALOG FOR THE DETERMINATION OF TEMPERATURE DISTRIBUTION. (PROJECT SQUID). G. A. Sterbutzel and J. L. Beal. Oct. 1952. 40p. (CAL-44)

6446

Langley Memorial Aeronautical Lab., NACA

METHODS FOR DETERMINATION AND COMPUTATION OF FLOW PATTERNS OF A COMPRESSIBLE FLUID. Stefan Bergman, Brown Univ. and Langley Memorial Aeronautical Lab., NACA. Sept. 1946. 80p. (NACA-TN-1018)

A method of generating stream functions of an incompressible fluid by taking the imaginary part of an analytic function of a complex variable has been extended to the case of supersonic flow of compressible fluids. Computations required for obtaining flow patterns of a compressible fluid from analytic functions of a compressible fluid are presented. The operations are divided into 2 groups: those which need to be carried out only once and then tabulated (or put on master cards) and those which have to be repeated in every individual case. The performance of necessary computations on punch card machines is described. Some theoretical questions which, to a certain extent, completed the results of a previous report by the author on two-dimensional flow of compressible fluids (NACA-TN-972) are considered. These include discussions on questions in connection with the determination of flow patterns around a nonsymmetric profile and the use of linear integral equations for constructing flow patterns. Alterations which are necessary in order that the operator which has been introduced for subsonic flow may be transformed into an operator which generates stream functions of supersonic flow from 2 functions of one real variable are discussed. (J.A.G.)

6447

Lewis Flight Propulsion Lab., NACA

TEMPERATURES, THERMAL STRESS, AND SHOCK IN HEAT-GENERATING PLATES OF CONSTANT CONDUCTIVITY AND OF CONDUCTIVITY THAT VARIES LINEARLY WITH TEMPERATURE. S. V. Manson. July 1953. 62p. (NACA-TN-2988)

Working formulas are presented for the steady-state temperatures and thermal stress in heat-generating infinite plates of constant conductivity and of conductivity that decreases linearly with temperature as the tempera-

ture increases, for the case in which the heat is generated uniformly throughout the plate thickness, and both faces of the plate are equally cooled. A criterion is indicated for determining the surface cooling conditions under which the thermal shocks at the surface and midplane will be smaller than, equal to, or greater than the steady-state thermal stresses at those planes. The dimensionless parameters governing the transient temperatures and thermal stresses in materials of linearly varying conductivity are derived by a similarity study of the conduction equation and boundary conditions of the transient state. A numerical technique for solving the transient-state equations is indicated in detail. (NACA)

6448

Lewis Flight Propulsion Lab., NACA
ANALYSIS OF TURBULENT HEAT TRANSFER AND FLOW IN THE ENTRANCE REGIONS OF SMOOTH PASSAGES. Robert G. Deissler. Oct. 1953. 88p. (NACA-TN-3016)

A previous analysis for fully developed turbulent heat transfer and flow with variable fluid properties is extended and applied to the entrance regions of smooth tubes and parallel flat plates. Integral heat-transfer and momentum equations are used for calculating the thicknesses of the thermal and flow boundary layers. The effect of variable properties is determined for the case of uniform heat flux, uniform initial temperature distribution, and fully developed velocity distribution. A number of other cases in which the fluid properties are constant are analyzed. The predicted Nusselt numbers for air with a uniform wall temperature and uniform initial temperature and velocity distributions agree closely with experimentally determined values. (auth)

6449

Sverdrup and Parcel, Inc.
THE CONTACT THERMAL RESISTANCE OFFERED BY THE WELDED JUNCTIONS BETWEEN A ROUND DUCT AND ITS ENCIRCLING STIFFENING WEBS. Carl A. Moore, Jr. Aug. 16, 1952. 49p. (NP-4802)

In calculating the stresses to be encountered in the stiffening web of a round duct through which hot air is to travel, the temperature distribution in the web must be known. Among the parameters which must be known is the thermal resistance to the flow of heat outward from the duct through the web. Since the web is welded to the duct, it becomes necessary to determine the thermal resistance of the various common types of welded joints. Actual experimentation with welds is difficult because of time involved, cost of model construction, and the difficulty of determining resistance of the models after their construction; however, Teledeltos paper and electrical analogue techniques can be used to solve this experimental problem, and a detailed account of the use of this method is presented along with the results which were obtained. (L.M.T.)

6450

HEAT EMISSION BY BODIES OF VARIOUS SHAPES IN LIQUIDS AND GASES WITH FREE CIRCULATION. II. Hermann Senftleben. *Z. angew. Phys.* 5, 267-70(1953) July. (In German)

Expressions derived in Pt. I (NSA 6-1202) for heat emission by vertical plates and horizontal and vertical cylinders in freely circulating gases or liquids are reconsidered as to validity and in the case of vertical cylinders are extended. (G.Y.)

6451

A NEW ANALOGY IN TRANSIENT HEAT CONDUCTION. R. E. Collins. *Am. J. Phys.* 21, 501-3(1953) Oct.

An equation of transient heat conduction is derived that involves the velocity of an isotherm and the rate of heat flow across the isotherm. This equation is analogous to the equation of wave theory that relates the group velocity and

phase velocity of the wave. The equation derived for heat flow serves as a criterion for the propagation of a temperature distribution without change of form in the same way that the analogous equation of wave theory serves a similar purpose. Under certain conditions the moving isotherms can be treated as moving heat sources. (auth)

6452

AXIAL FLOW IN A VORTEX. John B. Nuttall. *Nature* 172, 582-3(1953) Sept. 26.

A recent study of swirling fluid flow in a $2\frac{7}{8}$ -in. ID circular pipe has unexpectedly shown that reverse flow occurs in the center of the pipe for some rates of swirl and discharge. The average axial velocity was 1.5 ft/sec, $R = 3 \times 10^4$. The flow at $R = 1 \times 10^4$ was investigated with a smaller circular orifice. Dye was used for indicating fluid path lines, but no quantitative velocity measurements were made. At low rates of swirl the axial velocity at the pipe center was less than the maximum. As the swirl was increased, the axial velocity became negative at the center, and finally, for higher rates of swirl, the axial velocity was positive at the center but negative in a narrow region between the axis and the wall. No satisfactory explanation of this phenomenon has been found. It seems to be related to the reverse flow at the center of a Ranque-Hilsch vortex tube, although no thermal effects are present in this case. (G.Y.)

6453

ISENTROPIC PLANE FLOW OF A COMPRESSIBLE FLUID. Robert Legendre. *Compt. rend.* 237, 595-7(1953) Sept. 21. (In French)

Rapid methods are derived for establishing and solving the equations for plane isentropic flow of a compressible fluid. (G.Y.)

MATERIALS TESTING

6454

Langley Aeronautical Lab., NACA
AXIAL-LOAD FATIGUE TESTS ON NOTCHED AND UNNOTCHED SHEET SPECIMENS OF 61S-T6 ALUMINUM ALLOY, ANNEALED 347 STAINLESS STEEL, AND HEAT-TREATED 403 STAINLESS STEEL. Herbert F. Hardrath, Charles B. Landers, and Elmer C. Utley, Jr. Oct. 1953. 28p. (NACA-TN-3017)

Axial-load fatigue tests at a stress ratio of zero were performed on notched and unnotched sheet specimens of 61S-T6 Al alloy and 347 and 403 stainless steels. Special emphasis was placed on tests at high stress levels producing failures in small numbers of cycles. It was found that the stress-concentration factors effective in fatigue of notched specimens were somewhat less than the theoretical elastic values at low stresses and were approximately equal to one at the ultimate strength. The minimum life to failure at stresses near the ultimate strength was drastically reduced with increasing stress-concentration factor. (auth)

PUMPS

6455

Allis-Chalmers Manufacturing Co.
DEVELOPMENT OF ELECTROMAGNETIC PUMPS SUITABLE FOR PUMPING LIQUID METALS. FINAL REPORT. Jacob F. Asti. June 30, 1952. 318p. (NP-4892; Report 43-109)

A history and description of the work done on electromagnetic pumps and their auxiliaries and power supplies are presented. (J.E.D.)

VACUUM SYSTEMS

6456

Carbide and Carbon Chemicals Co. (K-25)
MODIFIED HOKE CONNECTOR. E. C. Evans and A.

Langdon. Issued Sept. 22, 1953. 8p. (K-1031)

The standard Hoke cone-type connector may be modified to facilitate its operation and greatly reduce the maintenance required. The method of adapting the connector to use a neoprene O-ring and the favorable experience with several modified connectors are described. (auth)

6457

Mound Lab.

A LARGE-DIAMETER RECIPROCATING-ACTION VACUUM VALVE. George L. Fox. May 22, 1953. 7p. (MLM-850)

A high-vacuum valve capable of connecting a system to either a low-vacuum or high-vacuum pump has been constructed from 2 Al pistons fitted with standard O rings and sliding in a 1-in. Pyrex pipe. This valve is $19\frac{1}{2}$ in. long and has the vents to the vacuum pumps and the system so arranged that the forces on the pistons are continually balanced during all operations. The total lateral movement of these pistons is $5\frac{1}{2}$ in. This movement is accomplished by a steel rod moving through an O-ring sealing gland in the capped end of the Pyrex pipe. In any evacuation position the air flows through the entire diameter of the tubing unrestricted. The valve is compact, requires little maintenance, and is easily adapted for remotely controlled vacuum systems. It may be constructed of either glass or metal and may be practically any size. Pressures of 10^{-6} to 10^{-7} mm Hg have been obtained in apparatus in which this vacuum valve was used. (auth)

6458

A VIBRATING NEEDLE VARIABLE GAS LEAK. A. J. Stinnett. Rev. Sci. Instr. 24, 883-4(1953) Sept.

A drawing gives in detail the construction of this solenoid-operated variable-leak needle valve. With alternating current, the valve needle is vibrated axially, alternately opening and closing at twice the frequency of the current supplied. By limiting the length of the stroke of the needle with an adjusting screw, the gas flow can be regulated from zero to nearly full opening. Change in pressure can be controlled in the 10^{-5} mm range as closely as the DPI ion gage can be read. Since the leak is electrically operated, it is especially well suited to control through a servo link activated by an ion-gage circuit if it is desirable to have the leak self-operating. (auth)

6459

A QUICK-CHANGE SEAL OPENER. W. R. Smith. Rev. Sci. Instr. 24, 886-7(1953) Sept.

The cylindrical stem upon which the target assembly of the ORNL 86-in. cyclotron is mounted passes through a vacuum lock and terminates in a H_2O header through which H_2O is transmitted to and from the inner passages of the stem. Three Wilson seals are used, one where the target stem enters the vacuum lock and two in the H_2O header. One seal in the header being in the reverse position makes it difficult to insert the stem. A seal opener was devised which consists of a 16-threads-per-in. quadruply threaded nut having a thin-walled sleeve which forms a part of the seal body when in retracted position. Clearance is provided so that the nut can be rotated $\frac{1}{2}$ turn, thus causing it to travel inward $\frac{1}{8}$ in., forcing the sleeve between the target stem and the seal gaskets. This holds the gaskets open and allows the stem to be replaced without shearing the edges of the gaskets. (L.M.T.)

6460

NEW DEVELOPMENTS IN THE PRODUCTION AND MEASUREMENT OF ULTRA HIGH VACUUM. D. Alpert. J. Appl. Phys. 24, 860-76(1953) July.

A new vacuum technology is described which makes it possible to achieve working pressures as low as 10^{-10} mm Hg in a routine and straightforward fashion. This is ac-

complished without the use of chemical getters, special traps, or refrigerants of any kind. Essential to this technology are several new instruments which have been especially developed for the production or measurement of ultra high vacua. These new tools have permitted a number of researches concerning the phenomena which occur at very low pressures to be carried out. The ultra high-vacuum technology has also made possible a new experimental approach in the fields of gaseous and physical electronics. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

6461

Technical Information Service, AEC

A BIBLIOGRAPHY OF SELECTED AEC REPORTS OF INTEREST TO INDUSTRY. PART 1. METALLURGY AND CERAMICS. Oct. 1953. 38p. (TID-3050(pt.1))

Abstracts of 219 selected references on metallurgy and ceramics are collected from unclassified reports on research and development work sponsored by the AEC. The bibliography includes a subject indexing and an availability list of the reviewed documents. (K.S.)

CERAMICS AND REFRACTORIES

6462

Aeronautical Lab., Fishermen's Bend, Melbourne (Australia) THE PREPARATION OF LABORATORY WARE IN BERYLLIA BY SLIP CASTING. A. R. Edwards and F. Henderson. Nov. 1948. 13p. (ATI-76656; Structures and Materials Note 174)

6463

Armour Research Foundation

INVESTIGATION OF REFRACTORIES SUITABLE FOR MELTING TITANIUM AND ITS ALLOYS. SUMMARY REPORT FOR THE PERIOD APRIL 10, 1951 TO AUGUST 10, 1952. M. Eisenberg and J. A. Stavrolakis. Aug. 1952. 32p. (NP-4812; AD-6939)

Theoretical analysis of the published data pertaining to simple and complex fluorides suggested that it would be possible to produce certain fluoride and oxyfluoride complexes with melting points high enough to render them infusible at the temperature of molten Ti. Because of their potentially high chemical stability and the noncontaminating nature of the products of reaction between fluorides and Ti, fluorides seem particularly desirable as possible container materials for molten Ti. Attempts were made to prepare several synthetic oxyfluoride minerals, as well as a number of new oxyfluoride compounds. Though it was possible to produce highly refractory fluoride ceramics, success was not attained in producing the exact compound desired. Nor was the product completely stable within the required temperature range. An analysis of the results suggests that the optimum fabrication technique was not achieved. Under the handicap of pronounced instability, a number of the complex fluoride refractories produced were nevertheless superior to zirconia in resistance to molten Ti. However, a product suitable for industrial application has not yet been produced. (auth)

6464

Research Foundation, Ohio State Univ.

STUDY OF THE MICROSTRUCTURE OF CERMETS. Harold M. Greenhouse and Herbert W. Newkirk. Mar. 1,

1953. 12p. (NP-4838; Bimonthly Report 12)

A new technique, the "lucite-Pt" method, used to produce replicas for the electron microscope is described briefly. The TiC particles smaller than 2000 Å in the Ni phase of a cermet were studied with an electron microscope. It was concluded that the TiC grains diffract light and cause the mottled appearance of the Ni phase which is observed under an optical microscope. At elevated temperature the grains, in time, merge and form a continuous TiC layer. (J.S.R.)

6465

Naval Research Lab.

THE MANUFACTURE AND PROPERTIES OF PAPER MADE FROM CERAMIC FIBERS. Thomas D. Callinan and Robert T. Lucas. Oct. 20, 1952. 7p. (NRL-4044)

During a continuing study of the properties of inorganic papers, the properties of ceramic fibers have been determined. The paper is mechanically weak when only ceramic fibers are used, but the electrical properties are exceptionally fine, and losses are one-fourth those of kraft paper. Mechanically strong paper can be prepared by adding resins to the furnish; additional strength may be imparted by the use of a filler such as bentonite. It was also found that dipping the paper in one of a number of varnishes markedly improved the mechanical and electrical properties. (NRL)

CORROSION

6466

Lewis Flight Propulsion Lab., NACA

COEFFICIENT OF FRICTION AND DAMAGE TO CONTACT AREA DURING THE EARLY STAGES OF FRETTING. 1. GLASS, COPPER, OR STEEL AGAINST COPPER. Douglas Godfrey and John M. Bailey. Sept. 1953. 23p. (NACA-TN-3011)

Experiments were conducted to measure the coefficient of friction, μ , and to determine the damage to the contact area during early stages of fretting of Cu at a frequency of 5 cycles/min. Specimen combinations of Cu against glass, Cu against Cu, and Cu against steel, as well as various Cu oxide films and powder compacts, were used. The results lead to the conclusion that fretting of Cu starts with the same mechanical damage that occurs during unidirectional sliding. Fretting of Cu against glass, Cu against Cu, and Cu against steel starts with adhesion and metal transfer (galling) with accompanying high μ values (>1.0) the same as those obtained during unidirectional sliding. After the initial high values of μ , a reduction in μ was observed, associated with reduced plowing and an increasing concentration of debris in and around the contact area. After approximately 100 cycles of fretting, μ reached a constant value (0.5 to 0.6) approximately the same as that obtained with compacts of either Cu_2O or CuO . The presence of preformed Cu_2O or CuO films on Cu does not delay the occurrence of fretting but only lowers the initial coefficient of friction. (NACA)

GEOLOGY AND MINERALOGY

6467

Wisconsin Univ.

NEW METHODS FOR URANIUM EXPLORATION AND RECOVERY FROM LOW GRADE ORES. RESEARCH PROGRESS REPORT, JANUARY 1, 1952 TO JANUARY 1, 1953. 24p. (AECU-2663)

The role of volcanism in the geochemistry of U is discussed from a theoretical standpoint. Various volcanic ashes, tuffs, lavas, etc., show higher α counts than other associated rocks. Special problems connected with the chemical analysis of low-grade rocks and ores are dis-

cussed. The HNO_3 leaching of U ores and adsorption and desorption of U on natural materials are briefly discussed. The following experiments which have been carried out in connection with the problem are discussed: α counting and U analyses of natural fluorite specimens; effect of α bombardment on the thermoluminescence of limestones; correlation of limestone deposits by thermoluminescence; and effects of α radiation on the energy storage, thermoluminescence, and light-absorption spectrum of LiF crystals. The abstracts of final reports on completed problems are presented. (L.M.T.)

6468

Geological Survey

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE RUBY-POORMAN AND NIXON FORK DISTRICTS, WEST-CENTRAL ALASKA, 1949. Max G. White and John M. Stevens. [1953] 22p. (GS-C-279)

Two small bodies of granite in the vicinity of Long in the Ruby-Poorman district contain an average of 0.005% equivalent U. Although the radioactivity is due chiefly to a uraniferous Th silicate tentatively identified as uranotorite, radioactive allanite, hematite, sphene, and zircon also contribute to the total radioactivity. Search for the bedrock source of a radioactive mineral of the spinel group which occurs in placers on upper Solomon Creek in the Poorman area was unsuccessful. It is concluded that there is little likelihood of finding U deposits of commercial grade in the Ruby-Poorman district. The only radioactive mineral of major importance in the Nixon Fork mining district is uraniferous thorianite. Uraninite has been identified in a concentrate that may have come from a placer mine in the district. (A.G.W.)

6469

Geological Survey

RECONNAISSANCE DURING 1952 FOR URANIUM-BEARING CARBONACEOUS ROCKS IN PARTS OF COLORADO, UTAH, IDAHO, AND WYOMING. James D. Vine and Robert F. Flege, Jr. June 1953. 19p. (TEI-336)

A reconnaissance for U-bearing carbonaceous rocks was made during the 1952 field season in 23 areas in Colo., Utah, Idaho, and Wyo. Uranium in small amounts occurs in several of the areas examined, but no deposits were found that might have commercial possibilities. As much as 0.03% U is in the ash of coal in the Caribou Mountain area in southeastern Idaho; 0.012% in the ash of coal in the Burnt Fork area of southwestern Wyo.; and 0.009% in the ash of coal from near Driggs in eastern Idaho. Seven additional areas were examined in which beds of coal or carbonaceous shale contained more than 0.002 but less than 0.007% U in the ash. Unweathered samples of bituminous sandstone from the Vernal area, Utah, contain minor quantities of U. Only those areas that may contribute to future studies on the occurrence of U in carbonaceous rocks are discussed. A complete tabulation of all analytical data resulting from the work is listed. (auth)

6470

DETERMINATION OF THE ABSOLUTE AGE OF A PITCH-BLENDE FROM THE CROUZILLE VEIN DEPOSIT IN THE GRANULITIC MASSIF OF ST. SYLVESTRE, NORTH OF LIMOGES. André Demay. *Compt. rend.* 237, 48-50 (1953) July 6. (In French)

Age determination by three methods, (1) relative contents of U, Th, and radiogenic Pb, (2) Pb^{207}/U ratio, and (3) $\text{Pb}^{207}/\text{Pb}^{208}$ ratio, gave the most probable absolute age as 147 million yr, corresponding to the beginning of the Jurassic or the end of the Triassic. The vein is thus clearly younger than the granulite, which is at least 200 million yr old. (G.Y.)

6471

A NOTE ON THE LEAD ISOTOPE METHOD OF AGE DETERMINATION. D. W. Allan, R. M. Farquhar, and R. D. Russell. *Science* 118, 486-7(1953) Oct. 23.

Recent methods proposed for dating Pb ores by the variation in common Pb abundances would not be correct if the ores used for the original calibration had not been dated correctly. The purpose of this note is to demonstrate that common Pb abundance-time expressions can be obtained without the use of dated samples. Expressions for the abundance-time curves can be obtained from the older Pb ores, without assigning ages to them, since it is assumed that less variation in Pb, U, and Th content has occurred in older samples than in more recent ones. (G. Y.)

METALS AND METALLURGY

6472

Ames Lab.

THE NIOBIUM-THORIUM ALLOY SYSTEM. J. M. Dickinson, O. N. Carlson, and H. A. Wilhelm. Aug. 13, 1953. Decl. without deletions Oct. 19, 1953. 13p. (AEC-3544; ISC-391)

The Nb-Th alloy system has been investigated by x-ray, thermal, metallographic, and resistance methods, and a phase diagram for the alloy system proposed. Nb forms a eutectic with β Th at 1435°C at 8% Nb. The extent of solid solubility is very limited at both ends of the system at all temperatures. The maximum solubility is believed to be less than 1% Nb in Th at the eutectic temperature. The addition of Nb to Th lowers the reported α - β transformation slightly. No intermediate phases were found in the investigation of the alloys. (auth)

6473

Battelle Memorial Inst.

THORIUM-CARBON ALLOYS. R. M. Goldhoff, H. R. Ogden, and R. I. Jaffee. June 19, 1953. Decl. Sept. 9, 1953. 52p. (AEC-3560; BMI-844)

A study has been made of the methods of melting Th-C alloys, and of the effects of these methods on the mechanical properties. Arc melting appears to be a better method for melting Th-C alloys than induction melting because the C content can be controlled more accurately. However, as long as the alloys are homogeneous, the melting technique has no effect on the mechanical properties. There is a good correlation between fabricability and C content. Alloys containing up to about 0.35% C can be hot rolled at 700°C with no cracks in the final sheet. However, cold rolling to a 50% reduction is limited to alloys containing less than about 0.25% C. Th-C alloys have been found to be amenable to age hardening in both the solution-annealed and the cold-worked conditions. By using a combination of cold working and aging, the yield strength of a Th alloy can be doubled. Such a combination of treatments appears to be the most effective way of obtaining yield strengths of the order of 60,000 psi. The recrystallization temperature of Th-C alloys in the range from 0.10 to 0.13% C is about 600°C. (auth)

6474

Battelle Memorial Inst.

THE PREPARATION OF HIGH-PURITY THORIUM BY THE IODIDE PROCESS. N. D. Veigel, E. M. Sherwood, and I. E. Campbell. Jan. 2, 1953. Decl. June 30, 1953. 16p. (AEC-3586; BMI-777)

The preparation of massive Th of high purity, in lots of several hundred g each, by the van Arkel-de Boer (iodide) process is described. Substantial reduction in the non-metallic content of the deposits over that of the feed ma-

terial was obtained. Optimum conditions for deposition were determined. (auth)

6475

Commonwealth Engineering Co. of Ohio
GAS PLATED COATINGS ON METALS AND ALLOYS.
PROGRESS REPORT. June 10, 1953. 12p. (AECU-2667; Progress Report 4)

The relation between plating temperature and plating rate for Cr metal on Cu-based Ni plate was studied, and a new variable-plating-temperature technique resulted in samples with brighter Cr alloy deposits than the previous one-temperature technique. The knowledge gained in these operations led to the successful codeposition of Cr and Ni. The α -phase alloy nature of the codeposit is strongly indicated by x-ray diffraction, and confirmation of its composition by microanalysis is being awaited. The successful deposition of Cr coatings that are both smooth and bright has been accomplished. (For preceding period see AECU-2699.) (auth)

6476

Battelle Memorial Inst.

ALLOYS FOR HIGH-TEMPERATURE SERVICE (INVESTIGATION OF THE FUNDAMENTAL FACTORS PROMOTING HIGH-TEMPERATURE STRENGTH OF ALLOYS). SUMMARY REPORT. R. L. Beck, E. E. Fletcher, A. R. Elsea, A. B. Westerman, and G. K. Manning. Mar. 31, 1952. 74p. (ATI-166644; U-22514)

Creep-rupture tests were made to determine the relative strength of the α - and β -phases in binary and N-bearing ternary Co-Cr-base and Vitallium-type alloys. High-temperature strength increased with increasing Cr, C, or N content. As-cast Vitallium-type alloys showed elevated-temperature strengths superior to those of homogenized specimens with or without aging; the creep resistance of the cast material was increased by aging. Some alloys had higher minimum creep rates under low than under high stresses; in the latter condition, more centers of nucleation were formed, and a larger number of smaller-size γ particles were precipitated. The highest prestresses gave the lowest creep rates. A dip occurred in the time-deformation curve prior to the beginning of second-stage creep; actual contraction of the specimens was observed in some instances. These curves appear to represent the summation of two opposing reactions; one is a normal tendency toward creep including the usual first-stage creep, and the other is a tendency toward contraction apparently resulting from the formation of a submicroscopic precipitate. The creep-rupture strengths of the α , β , and γ phases and three carbides ($M_{23}C_6$, M_6C , and Cr_7C_3) were observed in standard Stellite No. 21. Heat tinting was more effective in differentiating between the minor phases than chemical etchants. The upper limit of the α - β transformation temperature range for the standard Stellite was about 1000°C; Ni lowered the upper limit, and C and Mo raised it. The effect of C in raising the upper limit was more pronounced in homogenized than in cast materials; considerable C was tied up in the interdendritic islands of the cast structure. The temperatures at which the turbine blades in jet engines normally operate produce the mixed α - β structure possessing low creep-rupture strength. Homogenizing and cold working increased hardness after aging for 100 hr and lowered the aging temperature for maximum hardness. C, in the range of 0.10 to 0.36%, had little effect on the maximum hardness attained; the higher C material reached its maximum hardness at lower temperatures. Mo lowered the temperature at which maximum hardness occurred during aging of the homogenized and cold-worked material. (See also TIP U22405.) (auth)

6477

California Research and Development Co., Livermore
DYNAMIC CORROSION OF STEEL BY LIQUID BISMUTH.
O. J. Elgert and C. J. Egan. Aug. 29, 1952. 18p. (CRD-T1-74)

6478

Columbia Univ. School of Mines
A FUNDAMENTAL STUDY IN THE PRINCIPLES GOVERNING SEIZING AND GALLING IN METALS. QUARTERLY PROGRESS REPORT, MAY 6, 1953 TO AUGUST 6, 1953.
E. S. Machlin and W. R. Yankee. [1953] 5p. (CU-20-53-AF-75-Met)

Except for the case of Mg vs. Ti, it has been observed that the abnormal tendency of Ti to seize to other metals is due to the lack of a sufficiently thick protective oxide film that is resistant to penetration and removal in sliding contact. This film is absent on a Ti surface prepared by machining in air at room temperature. A protective layer can be introduced on the Ti surface by heating in air at 350°C. Several friction runs have been made with surface deliberately oxidized by heating in air. The friction coefficients obtained for various combinations are outlined. From these values it is apparent that the friction coefficients for the heated surfaces are markedly reduced relative to the clean surfaces. Thus, the conclusion that solid phase welding accounts for a major fraction of the friction coefficient in clean contact is valid. (auth)

6479

Ames Lab.
THE TITANIUM-VANADIUM SYSTEM. R. M. Powers and H. A. Wilhelm. September 1952. 174p. (ISC-228)

An investigation which included preparation, analysis, phase studies, and physical and chemical properties of Ti-V alloys was made, and the results, including a fairly complete phase diagram, are presented. Data are presented from a corrosion test of the alloys in steam at 315°C for 125 hr. A bibliography taken from a literature search which was made before beginning the investigation is included. (L.M.T.)

6480

Knolls Atomic Power Lab.
THE TITANIUM-HYDROGEN SYSTEM. R. M. Haag and F. J. Shipko. July 1, 1953. 42p. (KAPL-955)

The equilibrium pressure of H over Ti has been measured at 300, 400, and 500°C. Similar measurements have been made for Ti-D and Ti-T systems. At 500°C no isotope effect was observed. (auth)

6481

Livermore Research Lab., Calif. Research and Development Co.
ENDURANCE LIMIT OF CRYSTAL BAR ZIRCONIUM.
W. P. Wallace and R. H. Wallace. Issued Sept. 1953. 12p. (LRL-58)

Cantilever-loaded rotating-beam specimens were used in fatigue tests on crystal bar Zr. The results indicate that this metal does not have a clearly defined endurance limit. The stress for fracture at 101×10^6 cycles was determined to be 16,000 psi. Tensile and hardness properties and microstructure of Zr are reported. (auth)

6482

Institute of Engineering Research, Univ. of Calif., Berkeley
CORRELATIONS OF RUPTURE DATA FOR METALS AT ELEVATED TEMPERATURES. Raymond L. Orr, Oleg D. Sherby, and John E. Dorn. July 1, 1953. 36p. (NP-4765; Technical Report 27)

Stress-rupture data for pure metals and high-strength alloys at elevated temperatures are correlatable by means of the equation $t_r e^{-\Delta H_r/RT} = f(\sigma)$, where σ is the applied stress, T is the absolute temperature, t_r is the time to rupture, R is the gas constant, and ΔH_r is the activation

energy for rupture. These correlations are successfully applied to data for Al, Be, Ti, Ni, Nb, Mo, and several representative high-strength commercial alloys. ΔH_r is found to be a constant for a given metal and for relatively pure metals is believed to be equal to the activation energy for creep or self-diffusion. (auth)

6483

Magnesium Labs., Dow Chemical Co.
THE EFFECT OF TEMPERATURE ON THE LATTICE DIMENSIONS OF MAGNESIUM AND MAGNESIUM ALLOYS. Sept. 14, 1950. (NP-4784; Quarterly Status Report 1)

Progress was reported on an investigation of the effect of temperature on the lattice dimensions of Mg and its Al alloys. The lattice parameters were measured by the back reflection technique, using a Cu target and a flat cassette. The parameters were calculated by a modification of Cohen's method. A table shows lattice parameters and density for Mg from 10 to 597°C and for Mg-Al alloys from 25 to 121°C. (J.A.G.)

6484

Magnesium Labs., Dow Chemical Co.
FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT PROPERTIES OF MAGNESIUM. Dec. 11, 1950. 12p. (NP-4785; Quarterly Status Report 2)

A study of the effect of alloying ingredients on the properties of Mg included the effect of temperature on the unit cell size, the behavior of single crystals when deformed in a polycrystalline aggregate, a correlation of solid-solution hardness with alloy factors, and the effect of a critical electron concentration on energy absorption. (J.E.D.)

6485

Metallurgical Labs., Dow Chemical Co.
FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT THE PROPERTIES OF MAGNESIUM. June 18, 1952. 6p. (NP-4788; Quarterly Status Report 6)

A study was made of Mg solid-solution crystals in an attempt to explain the effect of alloy additions on the modes of deformation and solid-solution hardening. The standards used to select the alloying addition were: elements having maximum solid solubility at room temperature, high initial purity and relatively low density, and yielding a range of e/a ratios. It was indicated that Al and Li fulfilled the conditions, with Zn as a possible second choice. (J.E.D.)

6486

Metals Research Lab., Carnegie Inst. of Tech.
THE MECHANICAL PROPERTIES OF BAINITIC AND MARTENSITIC STEELS. ANNUAL SUMMARY REPORT FOR THE PERIOD FEBRUARY 1, 1952 TO FEBRUARY 1, 1953. Feb. 1, 1953. 101p. (NP-4815; AD-6153; Report 13)

Results of work on the effects of bainite on the mechanical properties of steel, the mechanism of the bainite reaction, and the flow and fracture characteristics of low-C martensites are summarized. (J.A.G.)

6487

Climax Molybdenum Co. of Mich.
[PROTECTIVE COATINGS FOR MOLYBDENUM ALLOYS] FINAL REPORT FOR DECEMBER 6, 1950-MARCH 5, 1952. J. R. Blanchard. 38p. (NP-4820; ATI-160067)

Molybdenum may be protected from oxidation at elevated temperatures by metal coatings which can be applied with metallizing spray equipment. This report summarizes a year's research effort to develop such sprayed metal coatings which could be applied commercially without impairing the properties of the Mo part; which could sustain thermal shock and some plastic deformation without destroying their protective value; and which could provide enduring protection for Mo at 1700°F or higher. Five different coating compositions, which were developed in

the course of this investigation, successfully protected Mo from oxidation in air at 1700°F for 500 hr. The most promising coatings consisted of 3 layers, of which the first and third layers were Alloy 13 (88% Al, 12% Si), and the intermediate layer comprised a mixture of 33% Al plus 67% of a Cr-Si alloy or 67% of a Cr-Mo-Si alloy. The coatings were sprayed onto Mo sheet panels and were metallurgically bonded in a H atmosphere by heating at temperatures in the range 1700 to 2000°F. The successful coatings were 0.009 to 0.016 in. thick. These coatings sustained several H₂O quenchings from elevated temperatures without detectable damage and withstood a fair degree of plastic deformation at 1700°F while continuing to provide protection for the Mo. The coating of 24 special stress-rupture specimens of Mo sheet is described. (auth)

6488

Institute of Engineering Research, Univ. of Calif., Berkeley
STATIC AND INTERMITTENT LOAD CREEP TESTS ON COLD ROLLED COMMERCIAL PURE TITANIUM AT 400°F; CONSTANT LOAD CREEP TESTS ON ANNEALED TITANIUM AT 400°F. Lawrence A. Shepard, C. Dean Starr, Carl D. Wiseman, and John E. Dorn. May 1, 1953. 19p. (NP-4852; Progress Report 22)

Constant and intermittent load creep tests were performed on cold-worked Ti (Ti-75-A) at 400°F. Constant load creep tests were also conducted on annealed Ti (Ti-75-A) at 400°F. Tensile tests at room temperature for both the cold-worked and annealed titanium are reported. In two groups of intermittent load tests, a 2-hr full-cycle time was used throughout. One group was maintained under load for 1 hr out of every 2, and the second for 1.5 hr out of every 2. At 400°F, the effect of constant and intermittent loading on the creep properties of cold-rolled Ti was less pronounced than the variations in the properties of this metal for the limited stress range investigated. (auth)

6489

Armour Research Foundation
DEVELOPMENT OF TRANSFORMATION DATA FOR SPECIAL TITANIUM ALLOYS. [PROGRESS] REPORT FOR THE PERIOD AUGUST 1, 1953 TO AUGUST 31, 1953. D. J. DeLazaro and D. J. McPherson. 3p. (NP-4887; [Progress] Report 2)

The evaluation of the transformation characteristics of the high-temperature β phase for each of a number of Ti-base alloys is briefly outlined. (For preceding period see NP-4762.) (J.A.G.)

6490

Rem-Cru Titanium, Inc.
THE SKULL FURNACE POURING AND CASTING OF TITANIUM SHAPES AND THEIR PROPERTIES; DEVELOPMENT OF PRODUCTION OF TITANIUM ALLOY CASTINGS FOR ORDNANCE APPLICATION. INTERIM TECHNICAL REPORT. [1953] 159p. (NP-4896; Interim Technical Report 3)

Skull furnaces were used to explore the castability of Ti and three of its alloys, including mold practice and the properties of castings so produced. The castability of unalloyed Ti, an all- α alloy Ti-7Al, an α - β alloy Ti-4Al-4Mn, and an all- β alloy Ti-10Mn-5Cr-5Mo were broadly investigated relative to such factors as fluidity, soundness, surface, shrinkage, macro- and microstructures, mechanical properties, and the effects on all these of a wide range of operating conditions including superheat, gas pressure, and a variety of mold conditions. In addition, a survey of mold materials, modes of manufacture, and design was conducted. Sound, strong, tough, good-surfaced, and good-dimensioned Ti alloy castings were made. Machined graphite and C molds were shown to be promising. Encouraging progress towards satisfactory, economical

molds was made in both rammed and shell mold techniques using powdered graphite and C. No basic difficulty in Ti castings was encountered; on the contrary the castability and properties of Ti and two Ti alloys were found to be good. (auth)

6491

Rem-Cru Titanium, Inc.
DEVELOPMENT OF PRODUCTION OF TITANIUM ALLOY CASING CASTINGS FOR ORDNANCE APPLICATION. FINAL TECHNICAL REPORT. May 14, 1953. 47p. (NP-4897)

Work is reported on the design and construction of a 25-lb bottom-pour, skull, arc melting furnace, the rehabilitation of a 100-lb tilt-pour, skull, arc melting furnace, the exploration of the castability of Ti and its alloys, and the evaluation of Ti and Ti-base alloy casting. The suitability of various mold materials for Ti casting was also determined. (J.E.D.)

6492

Metals Research Lab., Case Inst. of Tech.
THE EFFECT OF PRESTRAINING UNDER DIFFERENT STRESS STATES ON THE FRACTURE AND FLOW PROPERTIES OF 2S-O ALUMINUM; AN INVESTIGATION OF THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. I. Rozalsky. Oct. 1953. 48p. (NP-4902; Technical Report 28)

The effects of prestrain under conditions of different stress states but identical strain states upon the fracture and flow properties in tension were obtained for commercially pure (2S-O) Al. For prestrains of the same magnitude, a prestrain stress state of simple compression results in a higher retained tensile ductility than does a prestrain stress state of biaxial tension. Also, a change in prestrain stress state from simple compression to biaxial tension influences the shape of the fracture stress vs. prestrain curve but does not affect the shape of the yield strength vs. prestrain curve. (auth)

6493

Thomson Lab., General Electric Co.
WELDING CHARACTERISTICS OF MATERIALS FOR [AIRCRAFT GAS TURBINE] APPLICATIONS. A. J. Rosenberg. Feb. 8, 1951. 126p. (R51TL006)

This report attempts to combine, in a single publication, the available information on the welding characteristics of the materials normally useful for aircraft gas turbine applications. It is intended as a guide to the various materials, as well as a report on their welded properties. Periodic revisions will be issued to maintain the manual up to date. (auth)

6494

LESS COMMON METALS. W. R. Bekebrede and L. F. Yntema. *Ind. Eng. Chem.* 45, 2261-9(1953) Oct.

The problems associated with the working and fabrication of Ti and its alloys were investigated, and more information was accumulated on their chemical and galvanic corrosion behavior. The Zr literature was concerned with its corrosion resistance, welding techniques, and alloy systems. The improvement of the high-temperature strength of Zr by alloying was investigated. Information was published on the protection of Mo from oxidation and on its resistance to corrosion in H₂S, SO₂, Br, and I. Welding studies and properties of alloys were reported. The literature on Ta discussed corrosion rates and alloy systems. 134 references. (auth)

6495

THE EFFECT OF ALLOYING ELEMENTS ON WELDS IN TITANIUM. G. E. Faulkner, G. B. Grable, and C. B. Voldrich. *Welding J. (N.Y.)* 32, 481S-497S(1953) Oct.

Fe, Mn, Cr, and Mo are the principal β -stabilizing elements used as strengtheners in commercial Ti alloys. The effects of these elements on the mechanical and metallurgical properties of welded joints in Ti were studied in four series of experimental binary alloys prepared in compositions designed to cover the range where most of the useful alloys are expected to fall. Inert-gas-shielded W-arc-welded joints were made in $\frac{1}{8}$ -, $\frac{1}{4}$ -, and $\frac{1}{2}$ -in.-thick plates of the experimental alloys. These welded joints were studied for tensile, bend, and notch-toughness properties, hardness, and microstructure. The bend ductility of welded joints in the alloys with lowest alloy content was fairly good. However, the bend ductility decreased rapidly with increasing alloy content and became low when 3 to 6% alloy content was reached. Postweld heat treatment was successful in improving the bend ductility of most of the welded joints in alloys containing up to 6% alloying element. With one exception, welded joints in plates containing over 6% alloying element had low bend ductility in both the as-welded and heat-treated conditions. The exception was the 13% Cr metastable- β alloy which had excellent bend ductility in the as-welded condition. The trend in the notch-toughness properties of the welded joints with increasing alloy content was similar to the trend observed in the bend properties. The welded joints which had fair bend ductility generally had relatively good notch toughness, and those which had low bend ductility generally had low notch toughness. Transformation hardening of the weld metals and heat-affected zones appeared to be correlated with bend ductility and notch toughness in alloys containing up to 6% alloying element. Results indicate that factors such as freezing segregation, cast structure, and contamination may have contributed to the embrittlement of the welded joints in the higher alloys. Freezing segregation was observed in the weld metals of most of the metastable- β alloys. (auth)

B496

RECOMMENDED TECHNIQUES FOR POLISHING TITANIUM FOR METALLOGRAPHIC EXAMINATION. Roman Osadchuk, William P. Koster, and John F. Kahles. *Metal Progr.* 64, No. 4, 129-31, 236, 240(1953) Oct.

There is no single satisfactory method for preparing Ti and its alloys for metallographic examination. With simplicity of equipment and technique in mind, a basic procedure has been outlined which is believed to give results equal to those of any other method. Electrolytic polishing produces results almost equal to those obtainable by mechanical methods, and for most applications these results are entirely satisfactory. However, the greater relief in an electrolytically prepared surface may be objectionable for high-magnification photomicrography. This same relief may also cause trouble in examining the structures of fine-grained multiphased alloys at any magnification. This single drawback seems to be the only important objection to electrolytic preparation of Ti surfaces. (auth)

6497

SURFACE TENSION AND HEAT OF VAPORIZATION OF METALS. S. N. Zadumkin. *Doklady Akad. Nauk S.S.S.R.* 92, 115-18(1953) Sept. 1. (In Russian)

The surface tension and heat of vaporization of Ni, Na, K, Li, Cs, Rb, Zr, and Hf were determined experimentally. The results were in fair agreement with theory. (J.S.R.)

6498

EFFECT OF OXIDE FILMS ON DEFORMATION OF ALUMINUM IN ACTIVE AND INACTIVE MEDIA. L. A. Kochanova and B. Ya. Yampol'skii. *Doklady Akad. Nauk S.S.S.R.* 92, 119-22(1953) Sept. 1. (In Russian)

Al samples (1.45, 1.01, and 0.80 mm in diameter and 150 and 60 mm long) were heated in a H_2 atmosphere at 450° for 4 hrs. Films were produced at constant anode temperature

(7 to 8°), constant electrolyte concentration (20% H_2SO_4), and constant current (0.02 amp/cm²). At a film thickness of 25 μ the creep reaches a maximum. The number of film ruptures decrease with thickness and the adsorption effect increases. (J.S.R.)

PHYSICS

6499

Westinghouse Atomic Power Div.

THERMOCOUPLES OF TANTALUM, TUNGSTEN, AND MOLYBDENUM. R. K. McGeary. Aug. 18, 1952. Decl. June 19, 1953. 11p. (AEC-3541; WAPD-58)

Ta-W, Ta-Mo, and W-Mo thermocouples were calibrated in vacuo against a Pt-Pt-10% Rd couple at temperatures up to 1500°C. No evidence of liquation of any of the test couples in contact with Zr or Hf was noted at 1500°C. Ta-W couples have a high thermal emf (21 mv at 1500°C) which is reasonably linear with temperature and have a negligible room temperature compensation. Ta-Mo couples also have a high thermal emf but have the disadvantage that the thermoelectric power becomes small at the higher temperatures. W-Mo couples have a small thermal emf (less than 2 mv at 1500°) and a polarity reversal at 1230°C. Heating in vacua poorer than about 5×10^{-5} mm Hg causes embrittlement of Ta and W. Couples in which Ta was one element were found to have a stable emf without annealing only in vacua better than 3×10^{-5} mm Hg. These couples were tested in vacua as poor as 2×10^{-4} mm Hg, and stable calibrations were obtained by annealing at the maximum temperature and at the same pressure at which the calibration was made. (auth)

6500

Los Alamos Scientific Lab.

SEPARATION OF A SHOCK WAVE INTO ELASTIC AND PLASTIC WAVES, AND MEASUREMENT OF THE PRESSURE OF THE ELASTIC WAVE. [With Addendum] Stanley Minshall. Decl. June 17, 1953. [Presented] July 1-3, 1953. 24p. (AEC-3558)

Hydrodynamic theory predicts that if a shock wave in a metal is not too strong it will separate into two waves. The first wave will have the velocity of sound for the material and have the pressure of the dynamic compressive yield stress. The second wave will be a slower and a higher-pressure plastic wave. The velocity of the faster wave in steel and lead was investigated by Pack, Evans, and James by means of electrical contactors. This paper describes a modification of the contactor technique to determine the two velocities simultaneously for samples of steel and W alloy. The velocities of the sound, elastic, and plastic waves are: for steel, 0.590, 0.590, and 0.509 cm/ μ sec; for W alloy, 0.499, 0.492, and 0.444 cm/ μ sec, respectively. A further modification of the technique made possible the measurement of the pressure in the elastic wave. The average elastic-wave pressure of four samples of SAE 1020 steel was 11.8 kilobars and appeared to be independent of the plastic-wave pressure. Three samples of SAE 1045 steel gave indications that the front of the elastic wave was at a lower pressure than intermediate parts of the elastic wave. (auth)

6501

Laboratory for Nuclear Science, Mass. Inst. of Tech. ANNUAL PROGRESS REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953. May 31, 1953. 217p. (AECU-2616)

Separate abstracts have been prepared on 4 sections of this report.

6502

Laboratory for Nuclear Science, Mass. Inst. of Tech. CHEMISTRY OF THE FISSION ELEMENTS GROUP; COSMIC RAY GROUP; AND ELEMENTARY PARTICLE SCATTERING GROUP. D. N. Hume, L. B. Rogers, B. Rossi, R. W. Williams, H. S. Bridge, and J. R. Zacharias. p.1-80 of ANNUAL PROGRESS REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953. 80p. (AECU-2616(p.1-80))

Progress is reported on the following investigations: Cd halide complexes; Ag and Hg cyanide complexes; sulfide complexes of the fission elements; analytical chemistry of Ce, Nb, and In; reactions between permanganate and Ce^{+3} in various media; flame photometry; thermometric titrations; spectrophotometric determinations of inorganic substances in the ultraviolet; polarographic studies; electrodeposition studies of traces of elements; h-f titrimetry; operation of the multiplate cloud chamber at Echo Lake; construction of a new multiplate cloud chamber; the new unstable particles in cosmic rays; high-pressure rectangular double ionization chamber; ionization chamber experiments on nuclear interactions; east-west effect of positive and negative mesons near the equator; analysis of air shower data; measurement of the time distribution of particles in air showers; a large ionization chamber for air shower studies; an analysis of the meson component of cosmic rays in the atmosphere; spectrum of electrons from the decay of the μ -meson; photomeson production; proton-deuteron, proton-proton, and neutron-proton scattering with Van de Graaff generators; detection of high-energy nucleons; high-energy photoprotons from 320-Mev bremsstrahlung; and photonuclear experiments with the linear accelerator and the synchrotron. (J.S.R.)

6503

Laboratory for Nuclear Science, Mass. Inst. of Tech. NUCLEAR CHEMISTRY (INORGANIC) GROUP AND NUCLEAR CHEMISTRY (ORGANIC) GROUP. C. D. Coryell, J. W. Irvine, Jr., and J. D. Roberts. p.81-112 of ANNUAL PROGRESS REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953. 32p. (AECU-2616(p.81-112))

Progress is reported on the following investigations: design of a shield for low-level β radiation; survey of inorganic scintillators; solvent extraction studies; complex ions and ion-exchange studies; radiochemical studies of fission products; carbonium ion rearrangements; mechanism of the amination of aryl halides; and H isotope effects. (J.S.R.)

6504

Laboratory for Nuclear Science, Mass. Inst. of Tech. ONR GENERATOR GROUP, AND RADIOACTIVITY AND CYCLOTRON GROUP. W. W. Buechner, R. D. Evans, and M. S. Livingston. p.113-58 of ANNUAL REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953. 47p. (AECU-2616(p.113-58))

Progress is reported on the following investigations: inelastic scattering from light, self-conjugate nuclei; neutrons from the proton bombardment of Be^9 ; $B^{10}(d,p)B^{11}$ and $B^{11}(d,p)B^{12}$ reactions; deuteron-induced reactions of C, N, and O; inelastic scattering of protons from Ca; energy levels of K^{40} and V^{52} ; measurements of γ -ray scattering; positronium; development of a 4π solid-angle counter; cyclotron beam-intensity measurements; neutron binding energies; and ($Be^9 + p$) angular distributions. (J.S.R.)

6505

Laboratory for Nuclear Science, Mass. Inst. of Tech. SYNCHROTRON GROUP AND THEORETICAL GROUP. L. S. Osborne and V. F. Weisskopf. p.159-83 of ANNUAL REPORT [FOR PERIOD MAY 31, 1952 TO] MAY 31, 1953. 26p. (AECU-2616(p.159-83))

Progress is reported on the following investigations: photoproduction of charged pions from protons; study of plastic scintillators; shell model and the deformability of the nucleus; magnetic interactions of light nuclei; binding energy of H^3 ; nucleon-nucleon scattering; and spin-orbit coupling and oscillator energy levels. (J.S.R.)

6506

General Electric Research Lab. CONFERENCE ON CRYOGENICS, SCHENECTADY, NEW YORK, OCTOBER 6-7, 1952. 204p. (NP-4840)

This report is an expanded collection of papers on cryogenics and related topics, presented at a conference sponsored by ONR and NSF. Subjects covered include the structure, wave propagation, heat transfer, and flow characteristics of superfluid He^3 ; second-sound properties below $1^\circ K$; He-film transport over various materials; He^3 - He^4 heat separation; specific heat and thermodynamic properties of materials at liquid-He temperatures; demagnetization and liquefaction techniques; resistance of materials at low temperatures; superconductivity and superconductive properties of materials at liquid-He temperatures. (K.S.)

6507

Little, Arthur D., Inc. LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS, WITH SUPPLEMENTS 1 AND 2. Oct. 1952. 82p. (NP-4859)

This bibliography contains abstracts and lists of reports covering both theoretical and experimental research, techniques, and equipment for research at temperatures of $20^\circ K$ and below. Reports issued from 1945 through 1951, including pertinent works noted in Science Abstr. and Chem. Abstr. are included. (C.H.)

6508

Massachusetts Inst. of Tech. SHORTING AND FIELD CORRECTIONS IN HALL MEASUREMENTS. W. F. Flanagan, P. A. Flinn, and B. L. Averbach. Aug. 1953. 13p. (NYO-3822)

A method is given for correcting the measured Hall voltage for shorting by the current contacts and for inhomogeneities in the applied magnetic field. This method is applied to measurements of the Hall coefficient in Au-Ag alloys. (auth)

6509

ON THE HYDRODYNAMICS OF NON-VISCOUS FLUIDS AND THE THEORY OF HELIUM II. PART III. R. Kronig. Physica 19, 535-44(1953) June. (For Part II, cf. NSA 7-848)

It is shown that, disregarding irreversible effects, the phenomenological equations of the two-fluid model of He II can be derived exactly from Landau's kinetic picture in which this substance is considered at the absolute zero of temperature as a nonviscous fluid, subject at higher temperatures to wave-like excitations. The discrepancies to which previous treatments seemingly gave rise disappear on a more careful analysis of the problem. (auth)

6510

ON THE MOLECULAR THEORY OF LIQUID HELIUM. IV. THE COÖPERATIVE CHARACTER OF THE λ -POINT TRANSITION. I. Prigogine and J. Philippot. Physica 19, 508-16(1953) June. (In French)

The coöperative character of the transition of the λ point is studied by means of the cell model. It is shown that, because of a sharp diminution of the excitation energy with an increasing number of fluctuations, the specific heat must present a singularity. The nature of this singularity is discussed. (auth)

AEROSOLS

6511

Georgia Inst. of Tech. State Engineering Experiment Station INVESTIGATION OF AGGREGATION OF FINE PARTICLE MATTER SUSPENDED IN AIR. J. M. Dallavalle, Clyde Orr, Jr., and B. L. Hinkle. Dec. 14, 1952. 30p. (AD-766; Quarterly Report 6)

An investigation was made of the conditions under which particles aggregate when suspended in the atmosphere. The nature of the forces, electrical or otherwise, which lead to coalescence were investigated, and methods are described for measuring the electrification of aerosol particles. The electrification of a tobacco smoke aerosol was found to be only slightly affected by the presence of vapors of NH_3 , propylene glycol, methanol, and water. An NH_4Cl aerosol, formed by atomizing an alcoholic solution of the salt, was found to be highly charged, with a slight excess of negatively charged particles. A mathematical expression was developed to permit estimation from the experimental data of the electronic charge carried by individual aerosol particles, and results are presented which are in general accord with the data of previous investigations where comparison is possible. An aerosol particle counter was constructed which permits quantitative evaluation of the aggregation of aerosol particles. Results of preliminary tests of the instrument are reported. (auth)

6512

Polytechnic Inst. of Brooklyn

THEORETICAL INVESTIGATION OF THE GROWTH OF AEROSOL PARTICLES BY DIFFUSION. H. L. Frisch and F. C. Collins. [1951] 18p. (AD-3380; Report 1)

The effect of adiabatic cooling and heating on the growth rate of aerosol droplets is evaluated. The magnitude of the temperature rise at the surface of the droplet due to the liberation of the heat of condensation is obtained, and the result of this temperature rise on the growth process is investigated. An error in the previously calculated flux rate for a multiplicity of droplets in the diffusion field has been rectified, and the growth-rate law obtained for this case. (auth)

6513

A TECHNIQUE FOR COLLECTING, MOUNTING, AND SECTIONING AIRBORNE PARTICULATE MATERIAL. R. D. Cadle, A. G. Wilder, and C. F. Schadt. *Science* **118**, 490-1(1953) Oct. 23.

A technique has been developed for mounting and sectioning aerosol particles without removing them from the cellulose acetate-cellulose nitrate filters. When mounted in methyl methacrylate plastic these filters become transparent. The individual particles can be ground and polished into thin sections mounted in a thin disk of plastic in a form convenient for study with a petrographic microscope or with chemical micrurgic techniques. (G. Y.)

ASTROPHYSICS

6514

LYMAN-ALPHA RADIATION IN THE SOLAR SPECTRUM. E. T. Byram, T. Chubb, H. Friedman, and N. Gailar. *Phys. Rev.* **91**, 1278-9(1953) Sept. 1.

The $\text{H}\alpha$ line in the solar spectrum was observed at altitudes above 74 ± 2 km. Data were accumulated on the absorption of this line up to 128 km. A value of $0.01 \text{ erg cm}^{-2} \text{ sec}^{-1}$ per 100A was determined for the solar emission background near 1200A. (K. S.)

COSMIC RADIATION

6515

ORIGIN OF COSMIC RAYS. I. S. Sklovskii. *Doklady Akad. Nauk S.S.S.R.* **91**, 475-8(1953) July 21. (In Russian)

The theory of the galactic origin of cosmic rays is discussed. (J.S.R.)

6516

SPECTRA OF THE IONIZING PARTICLES OF COSMIC RADIATION IN THE STRATOSPHERE. N. L. Grigorov, I. D. Rapoport, and G. P. Shipulo. *Doklady Akad. Nauk S.S.S.R.* **91**, 491-4(1953) July 21. (In Russian)

Measurements of the ionizing capacity of cosmic rays in the stratosphere were made with integral ionizing chambers and small single counters at heights from 17 to 18.5 km. The ionization increased with height, and it was concluded that at least 80% of the particles at 18 km ionize relatively. (J.S.R.)

6517

INVESTIGATION OF THE ELECTRON-NUCLEAR SHOWERS AND PENETRATING PARTICLES IN THE ATMOSPHERE AT DIFFERENT LATITUDES. S. N. Vernov and A. N. Charakhch'yan. *Doklady Akad. Nauk S.S.S.R.* **91**, 487-90 (1953) July 21. (In Russian)

Measurements of the intensity of the ionizing component and the number of electron-nuclear showers in cosmic radiation were made at the geomagnetic latitudes 50°N , 31°N , and 2°S . The arrangement of the counting apparatus is diagrammed. The number of ionizing particles and number of electron-nuclear showers are graphed against the depth of Pb foil penetration. (J.S.R.)

6518

THE ABSORPTION OF HIGH ENERGY COSMIC RAY PHOTONS. M. Bruin and J. Clay. *Physica* **19**, 719-28 (1953) Aug. (In English)

An experiment was conducted to measure the absorption coefficient α in cm^{-1} of the photon component of cosmic ray extensive air showers. The values found in the energy range of about 100 to 1000 Mev proved to be 0.006 ± 0.005 for paraffin, 0.005 ± 0.005 for C, 0.088 ± 0.009 for Al, 0.53 ± 0.07 for Fe, 0.76 ± 0.10 for Sn, and 1.4 ± 0.2 for Pb. These values agree with those obtained with photons in the high-energy range provided by accelerators and with those obtained for photons belonging to the continuous cosmic radiation. (G.Y.)

6519

ON THE POSITIVE EXCESS OF MESONS OF HIGH ENERGY. E. Beretta, I. Filosofo, B. Sommacal, and G. Puppi. *Nuovo cimento* (9) **10**, 1354-6(1953) Sept. 1. (In English)

The results of a series of measurements on the positive excess of high-energy μ mesons made underground at depths of 1400, 2400, and 4050 g/cm^2 equivalent air thickness are reported. These depths correspond to the differential energy bands of 3.2, 5.5, and 9.5 bev in the spectrum of the mesons at sea level. P/N ratios of 1.266 ± 0.006 , 1.257 ± 0.013 , and 1.247 ± 0.02 were found, giving positive excesses of 23.4 ± 0.4 , 22.7 ± 1.1 , and $22.0 \pm 1.7\%$. It is concluded that, at least for the energy intervals investigated, the μ mesons found underground are only those that pass sea level and are slowed down by electromagnetic interactions only. It is also deduced that the mean excess is a very slowly varying function of the energy of the mesons. The mean multiplicity for μ meson production is estimated, and the balance sheet for very high-energy atmospheric phenomena is discussed. (G.Y.)

6520

THE "JETS" OF MESONS IN NUCLEAR EMULSIONS. S. Bertolino, A. Debenedetti, G. Lovera, and M. Vigone. *Nuovo cimento* (9) **10**, 991-2(1953) July 1. (In Italian)

An Ilford G5 emulsion, exposed to cosmic radiation at 22 km, contained showers of mesons accompanied by a small number of "jet" tracks. The number of tracks vs. energy of the primary is graphed. (J.S.R.)

6521

PRELIMINARY RESEARCH ON V_1^0 EVENTS IN EMULSIONS. E. Amaldi, C. Castagnoli, G. Cortini, and A. Manfredini. *Nuovo cimento* (9) 10, 1351-3(1953) Sept. 1. (In English)

Preliminary measurements intended to establish the practical possibilities of recognizing and measuring V_1^0 events in nuclear emulsion are reported. The research has been restricted to V_1^0 events corresponding to a neutral particle decaying into a proton and a negative pion with a Q of 37 Mev. Of 872 two-prong stars examined, six are probably the result of V_1^0 decays. These events mainly have lower momenta and higher interprong angle than those observed with cloud chambers. (G.Y.)

ELECTRICAL DISCHARGE

6522

Research Lab. of Electronics, Mass. Inst. of Tech. METHODS OF MEASURING THE PROPERTIES OF IONIZED GASES AT HIGH FREQUENCIES. 3. MEASUREMENT OF DISCHARGE ADMITTANCE AND ELECTRON DENSITY. Sanborn C. Brown and David J. Rose. May 6, 1952. 12p. (NP-4854; Technical Report 230)

In two previous reports (*J. Appl. Phys.* 23, 711, 719(1952)) methods were developed for measuring the Q and the electric field in microwave cavities used for gas-discharge work. This paper extends the techniques to include the properties of the discharge itself; in particular, of its complex admittance and electron density. As in the preceding reports, the most elegant methods apply to high- Q cavities, and thus necessarily to low electron-density discharges. At microwave frequencies, however, this restriction is not too severe for many purposes. Even if the discharge is not maintained in a high- Q cavity and the electron density is high, some analysis can be made of the problem; this matter is also discussed. (auth)

6523

Westinghouse Research Labs. BREAKDOWN IN VACUUM UNDER THE INFLUENCE OF SOLID DIELECTRICS. P. H. Gleichauf and G. C. Thomas. Nov. 25, 1947. 26p. (R-94432-4-A)

ELECTRONS

6524

AUGER PEAKS IN THE ENERGY SPECTRA OF SECONDARY ELECTRONS FROM VARIOUS MATERIALS. J. J. Lander. *Phys. Rev.* 91, 1382-7(1953) Sept. 15.

The energy spectra of secondary electrons from C, Be, Al, Ni, Cu, Ba, Pt, and the oxides of Be, Al, Ni, Cu, and Ba have been measured with equipment of high stability and sensitivity. Characteristic peaks due to Auger electrons emitted as a result of absorption of a valence electron by an excited x-ray level were observed for all these materials. The peaks exhibit structure which is of some theoretical interest. The structure can be related to the distribution in energy of electrons in the valence band, and it complements that observed in soft x-ray emission work. Since the emission of the Auger electron is not subject to the selection rules governing the emission of x radiation, additional information can be obtained from the Auger electron energy distribution. Excitation of Auger peaks by a beam of low-velocity electrons provides an interesting technique for surface analysis. "Plasma" peaks of the type reported by Ruthemann, and interpreted by Pines and Bohm, were also observed. (auth)

6525

THE THRESHOLD OF ELECTRON EMISSION IN NICKEL AND MOLYBDENUM. A. R. Skul'man and E. I. Myakinin. *Doklady Akad. Nauk S.S.S.R.* 91, 1075-8(1953) Aug. 11. (In Russian)

The threshold of electron emission in Ni and Mo is measured for different energies of the incident electrons. The emission curves are given, and the velocity of the emitted electron is compared with the energy of the incident electron. (J. S. R.)

6526

ELECTRON FLOW THROUGH SMALL TUBES WITH MAGNETIC FOCUSING. John L. Stewart. *J. Appl. Phys.* 24, 1236-40(1953) Sept.

When a uniform finite magnetic field passing through the cathode is used for focusing a beam of electrons, random emission at the cathode results in the electrons traveling down the beam in a helical manner. Such a rotational motion severely limits the amount of current that can be made to travel through a small tube or between closely spaced parallel plates. The amount of current transmitted through such structures is calculated and presented in the form of normalized curves. It is assumed that the current initially fills the tube or the region between the parallel plates. If an alternating electric field having a frequency comparable to the rotational frequency of the electron is applied normal to the beam, the average electron radius of motion is increased. Should the electron beam be made to flow through a tube after the application of such an alternating electric field, the current transmission through the tube will be reduced over that when no electric field exists. The first-order correction term for this case is calculated and presented in the form of normalized curves. The fact that the average electron radius is increased when an electric field is present implies added energy and leads to the formulation of a conductance expression relating the power in the rotational motion of the beam to the electric field normal to the beam. The current interception and the equivalent beam conductance are important in many electronic devices such as traveling-wave tubes. The beam conductance may be quite large in some cases—on the order of that present off the axis of a helix. (auth)

6527

SPATIALLY ALTERNATING MAGNETIC FIELDS FOR FOCUSING LOW-VOLTAGE ELECTRON BEAMS. J. R. Pierce. *J. Appl. Phys.* 24, 1247-8(1953) Sept.

The advantages of using periodic axially symmetrical magnetic fields for the focusing of low-voltage electron beams are summarized. Alternating fields, when compared to unidirectional fields, are found to die off at a much faster rate in the transverse direction, which means that for alternating fields there is less magnetic stored energy away from the axis. Thus, a given mean-square magnetic field can be produced with a much smaller magnet, and at the same time the stray field external to the structure can be reduced. For example, the same focusing was achieved with a series of ring magnets (wt. 1 lb, 5 oz) as had been achieved previously with a uniform-field magnet of weight 38 lbs. A discussion is presented of "stop bands," a feature of periodic focusing which was brought out during the experimental work. (L.M.T.)

6528

A MODIFIED THEORY OF PRODUCTION OF SECONDARY ELECTRONS IN SOLIDS. A. van der Ziel. *Phys. Rev.* 92, 35-9(1953) Oct. 1.

A few difficulties in the previous theories of energy loss and secondary-electron production by primary electrons in metals can be removed by replacing the Coulomb interaction between a primary electron and a lattice electron by a screened Coulomb interaction, such as required by the plasma theory. In the new theory Wooldridge's mechanism of secondary-electron production seems to have lost most of its importance. The energy-loss distribution due to the interaction with the conduction electrons of the metal is

found to have a maximum at an energy loss slightly less than $(\hbar^2 k_m^2 / 2m)$, where k_m is the value of the wave vector of the conduction electrons at the Fermi level. The theory is also applied to the bound electrons, and it is shown that the screened Coulomb interaction does not change the previous results very strongly. It is also shown that the polarization of the medium has only a small influence upon the previous results for insulators. (auth)

6529

SPACE-CHARGE EFFECTS IN FIELD EMISSION. J. P. Barbour, W. W. Dolan, J. K. Trolan, E. E. Martin, and W. P. Dyke. *Phys. Rev.* **92**, 45-51 (1953) Oct. 1.

A progressive reduction of the observed field current below values expected from the empirical law for increasing values of the potential is attributed to space charge. The current density expected in the presence of space charge is calculated from the Fowler-Nordheim field emission theory using values of the cathode electric field obtained from a solution of Poisson's equation for plane electrodes with boundary conditions appropriate to field emission. The result is a generalization of Child's equation and is asymptotic to it when the applied potential is large compared with the value required for appreciable field emission. Current densities predicted by the theory are compared with experimental values obtained for several values of the work function by use of the clean W and the Ba-on-W emitting surfaces in high vacuum. The Fowler-Nordheim theory correctly predicts the observed average current density from clean W for densities in the range from 2 amp/cm² to 4×10^7 amp/cm², thus extending a previous test of the theory which was limited to current densities less than 6×10^6 amp/cm². Significant features of the electron-emission pattern observed at high current densities are explained as effects of space charge. (auth)

GASES

6530

Engineering Research Inst., Univ. of Mich.
DEVIATIONS FROM THERMAL EQUILIBRIUM IN SHOCK WAVES. [Hans] A. Bethe, Cornell Univ. and [Edward] Teller, George Washington Univ. [nd] 82p. (NP-4898; [BRL-X-117])

The various terms contributing to the energy content of a gas, namely translation, rotation, vibration, electronic excitation, and dissociation, are discussed. Tables are given of the energy content and the specific heat of a simple harmonic oscillator and of the energy content and the dissociation of N₂, O₂, and air. The molecular vibration becomes important for air at about 600°K, the dissociation at about 3000°K. The theory of shock waves is generalized to the case when the specific heat changes with temperature. General formulas are obtained for the velocity, density, pressure, and temperature on the high-pressure side. It is shown that the asymptotic values of v , ρ , p , and T on the high-pressure side at sufficient distance from the front of the shock wave are uniquely determined by the values of these quantities on the low-pressure side and are independent of any intervening phenomena connected with the approach of statistical equilibrium between the various degrees of freedom of the molecule. Data are tabulated on the theoretical temperature dependence of the number of collisions necessary for de-excitation of the first vibration state, experimental results on the excitation of molecular vibrations, relaxation time and mean-free-path vibration for O₂ and N₂ in air, relaxation time and mean free path for the dissociation of air, and the characteristics of shock waves in air. (C.H.)

6531

Naval Research Lab., Univ. of Wis.
VIRIAL COEFFICIENTS AND MODELS OF MOLECULES IN GASES. Taro Kihara. June 5, 1953. 53p. (WIS-OOR-7; AD-13251)

A discussion is presented on the use of the square-well, Lennard-Jones, and inverse-power repulsive potentials for obtaining the second and third virial coefficients of spherical molecules. The effects of viscosity, isotopic thermal diffusion, and other transport properties of gases on the intermolecular potential are investigated. Only pure, nonpolar, nonquantum gases are considered, and only models are used which approximate real molecules and for which integrals can be evaluated. The second virial coefficient for nonspherical molecules is evaluated on the basis of a molecular core model. (L.M.T.)

INSTRUMENTS

6532

Atomic Energy Research Establishment, Harwell, Berks (England)
DEVELOPMENTS IN THE MAGNETRON AMPLIFIER. J. Dain. Aug. 1953. 8p. (AERE-GP/R-1228)

Possible future development of the magnetron amplifier in the light of recent experimental results is discussed. By scaling from existing experimental data, it is shown that the magnetron amplifier is unlikely to be superior to the klystron at high powers. At low powers, it may offer the advantage of relatively wide band operation. (auth)

6533

Ames Lab.
A SIMPLE LINE-OPERATED CONSTANT CURRENT SUPPLY. David E. Winkel and Harry J. Svec. Sept. 18, 1953. 10p. (ISC-409)

A simple line-operated constant-current supply is described. A circuit designed to maintain the plate voltage of a pentode constant to ± 0.25 v is presented. Performance data indicate that in the range 0 to 5 ma currents may be kept constant to $\pm 0.02\%$ for a load-voltage change of 0 to 400 v if line-voltage fluctuations are not great. Under certain conditions regulation to $\pm 0.007\%$ has been observed for a load-voltage change of 0 to 400 v. (auth)

6534

Office of Basic Instrumentation, National Bureau of Standards
ABSOLUTE MEASUREMENT OF VIBRATION AMPLITUDES. Walter Koidan. Sept. 1953. 34p. (NBS-2799)

By means of a modification of the pistonphone, a technique has been developed to obtain the response of a capacitance-type, vibration-pickup probe using the reciprocity calibration of a condenser microphone as a reference. The raised, center portion of a circular piston, driven by a Ba titanate cylinder, projects into one end of a 19.9-cc cavity, the shelf of the piston being located outside of the enclosure. A calibrated condenser microphone is coupled to the other end of the cavity and responds to the sound pressure developed by the piston. The output of an annular capacitance-type vibration pickup, which detects the motion of the piston shelf, is compared with the generated microphone voltage. With the microphone removed from the cavity, the output of the probe, located adjacent to the top surface of the piston, is compared with that of the annular pickup. The probe response is computed from these measurements and the microphone response. Mechanical coupling between the driver and the main supporting structure is minimized by the use of vibration mounts and the maintenance of a small, acoustically sealed clearance between the piston and the cavity enclosure. Calibrations of the probe have been obtained from 100 to

10,000 cps with an estimated probable error not exceeding 0.5 db. Peak vibration amplitudes as small as 10^{-8} cm can be measured with a comparable degree of accuracy by a similar probe built for high sensitivity. (auth)

6535

Research Foundation, Okla. Agricultural and Mechanical Coll.

A HIGH TEMPERATURE RADIATION CALORIMETER. FINAL REPORT. Irving Johnson. Aug. 31, 1953. 30p. (NP-4790)

The design of a spherically symmetrical calorimeter is described in detail. The theory of this calorimeter, operating in a deep vacuum, is discussed and compared with experimental results. Calibration data and cooling curves are presented. (J.S.R.)

6536

Chatham Electronics Corp.

TECHNICAL EVALUATION REPORT ON GAS REGULATOR TUBES; INTERIM REPORT [FOR] JANUARY 1, 1953 - MARCH 31, 1953. G. Edelcreek. Apr. 1953. 21p. (NP-4825; AD-6777; Interim Report 2)

Life tests are reported on 75-, 95-, 108-, and 150-v tubes, some of which were of the conventional He-A-misch metal structure, some of which had been processed with pure Ce or with no Ce in the misch metal, and others which had been constructed with surfaces produced by sputtering Mo or W in Ne-A atmospheres. (auth)

6537

Arkansas Univ. Engineering Experiment Station

DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT, OCTOBER 1, 1952 TO DECEMBER 31, 1952. Jan. 20, 1953. 11p. (NP-4845; AD-8014; Quarterly Progress Report 4)

Progress is reported on the development of a mass spectrometer in which no slits or magnets are used. The separation is made by accelerating the ions with a combination of a-c and d-c potentials, with the result that only those of a given mass charge ratio are admitted to the collector. The instrument is to be adapted to instantaneous analysis of gas mixtures. Most of the work this quarter on the operation of the r-f mass spectrometer tube is in connection with the improvement of the associated electronic circuits. In addition work is summarized briefly on a miniature vacuum system, a nozzle for kinetic studies, and commercial sealed refrigeration units for the mass spectrometer. (J.A.G.)

6538

Naval Research Lab.

A RADIO-FREQUENCY CIRCUIT FOR USE IN THE 300 TO 1000 MEGACYCLE RANGE. Frank C. Isely. Aug. 7, 1953. 17p. (NRL-4217)

A variable inductive line-type circuit for use within the range of frequencies from 300 to 1000 Mc has been developed with a tuning coverage up to two to one and with no metallic sliding or rotating contacts. The line can be built of metal (brass) or can be of low-loss plastic using plated or printed circuit techniques. The theory of the circuit is developed, and the methods of calculating size and spacing for a given range are shown. A straight-line tuning characteristic can be obtained in approximately 180° of rotation. These lines may be of the coaxial or of the two-wire type. Tubes required for wide coverage are of the low-inductance lead type, such as the 2C40, RCA Pencil 5876, or W.E. 416A. (auth)

6539

A TELESCOPING DIRECT BEAM TUNNEL. L. V. Azaroff. Rev. Sci. Instr. 24, 872(1953) Sept.

The elimination of side-scattered radiation from the

direct beam of an x-ray tube is accomplished by spring-loading a set of telescoping cylinders between the tube and collimator. (K.S.)

B540

A MICROWAVE FABRY-PEROT INTERFEROMETER.

J. O. Artman. Rev. Sci. Instr. 24, 873-5(1953) Sept.

Application of the Fabry-Perot interferometer principle is described in the construction of a high-Q microwave interferometer for free-space wavelength measurements. Q values of 40 and 10 are reported for wavelengths of 6 to 15 mm and below 6 mm, respectively. (K.S.)

ISOTOPES

6541

Rochester Univ.

A NEW NEUTRON-DEFICIENT ISOTOPE OF KRYPTON.

Albert A. Caretto, Jr. and Edwin O. Wieg. Sept. 21, 1953. 4p. (NYO-3841)

While investigating the spallation reactions which occurred when Y was bombarded with 150-, 175-, and 240-Mev protons in the Rochester cyclotron, a new Kr isotope, Kr^{78} , with a $9.7 (\pm 0.5)$ -hr half life was observed. Data on the decay scheme are presented. Parent-daughter isolation experiments were performed both to confirm the half life of Kr^{78} and its genetic relation with Br^{76} . (auth)

6542

PRODUCTION OF RADIOISOTOPES. A. F. Rupp and F. T. Binford. J. Appl. Phys. 24, 1069-81(1953) Sept.

Some of the practical problems encountered in the production of radioisotopes at Oak Ridge National Lab. are presented. Methods of irradiation, production rates, chemical processing, facilities, etc., are discussed. Data, including production methods, specific activity, etc., on ~100 radioisotopes which have been prepared, are presented in tabular form. (L.M.T.)

ISOTOPE SEPARATION

6543

Baird Associates, Inc.

PHOTOCHEMICAL SEPARATION OF ISOTOPES. PROGRESS REPORT COVERING THE PERIOD APRIL 1, 1952 TO JUNE 30, 1952. David Z. Robinson, Robert O'B. Carpenter, and M. Kent Wilson. Aug. 29, 1952. 30p. (NP-4834; AD-6184; Progress Report 2)

Experimental work on monoisotopic breeder lamps for use in separating Li isotopes involved studies of various coatings for the lamp interiors to prevent Li attacks on the silica of the ordinary electrodeless discharge lamp. Results from ten separate experiments with Hg and H_2O vapor are discussed. An enrichment of Hg^{198} from 10% to only 12% was indicated. (L.M.T.)

6544

KINETIC STUDY OF ISOTOPIC EXCHANGE REACTIONS BETWEEN SODIUM IODIDE AND ORTHOIODOPHENOL AND ORTHO-, PARA-, AND METAIODOTOLUENE. Serge May, Bernard Giraudel, and Jacques Regnault. Compt. rend. 237, 613-15(1953) Sept. 21. (In French)

The isotopic exchange of I^{131} ion with ortho-iodophenol is of over-all second order, and its activation energy is 23.6 kcal/mole in acetonitrile solvent. For the ortho-, para-, and meta-iodotoluenes, the exchange is first order with respect to the aromatic iodide in 2-octanol solvent and zero order with respect to the mineral iodide. The energies of activation are 38, 28, and 25 kcal/mole, respectively. (tr-auth)

6545

THERMODYNAMICS OF TRANSPORT PROCESSES IN IONIC MIXTURES AND ITS APPLICATION TO SALTS AND

METALS CONTAINING ISOTOPES. Alfred Klemm. *Z. Naturforsch.* **a8**, 397-400(1953) July. (In German)

In the thermodynamics of irreversible processes the following equation is used

$$K_i = \sum_k r_{ik} \gamma_{ik} (w_i - w_k), \quad r_{ik} = r_{ki}$$

($K_i = -\text{grad } \bar{\mu}_i$, $\bar{\mu}_i$ = electrochemical potential, γ_i = mole fraction, w_i = mean translation velocity of component i) to describe the conductivity κ and the self-diffusion constants D^+ and D^- , as well as the mass effect of the electrolytic cation and anion migration μ^+ and μ^- as functions of the coefficient of friction r_{ik} . From isotope-separation experiments it is found that in salts the friction of two isotopic cations in motion against each other is greater than the friction in the motion of the total cations against that of the total anions. Quantitatively, it is found that $z^- r^{+z} z^+ r^{+z} = 2.3$, where z^+ and z^- are the valences of the cations and anions, respectively. (tr-auth)

MASS SPECTROGRAPHY

6546

Watertown Arsenal Lab.

GENERAL LITERATURE SURVEY OF MASS SPECTROMETRY AND REVIEW OF ANALYSES OF SOLID SAMPLES. George A. Consolazio and Laurence S. Foster. *Aug. 15, 1952.* 29p. (WAL-122/35; AD-5545)

The field of mass spectrometry is surveyed. The early instruments and their later development to permit use of solid samples, new techniques, and new applications are discussed. Ion sources are surveyed, such as the vacuum vibrator, condenser discharge, high-vacuum spark, thermal emission, and furnaces. Some of the applications of mass spectrography to the analysis of solids are discussed, such as qualitative and quantitative analyses, separation of radioactive isotopes, tracer analysis, and the direct determination of the penetration of gases into metals. The dual-purpose mass spectrometer at the Watertown Arsenal Lab. is described. 44 references. (J.A.G.)

6547

MASS-SPECTROSCOPIC ATOMIC WEIGHT DETERMINATIONS. Heinz Ewald. Translated by Henry P. Kramer from *FIAT Rev. Ger. Sci. Inorganic Chemistry*, Pt. 1, p.12-25. 16p. (UCRL-Trans-58)

An abstract of this report appears in *Nuclear Science Abstracts* as NSA 4-78.

6548

AN ELECTRICAL METHOD FOR IMPROVING THE SEPARATING POWER FOR CERTAIN MEASUREMENTS; ITS APPLICATION TO MASS SPECTROMETRY. François Bertoin. *Compt. rend.* **237**, 389-91(1953) Aug. 3. (In French)

On the basis of a correlation between the object-image relation in optics and the signal-response relation in electrical circuits, a sweep circuit to improve the resolution in mass spectrometers is devised. (G.Y.)

6549

A NEW MASS SPECTROMETER WITHOUT A MAGNETIC FIELD. Wolfgang Paul and Helmut Steinwedel. *Z. Naturforsch.* **a8**, 448-50(1953) July. (In German)

Stability conditions and other electrical properties are derived for a mass spectrometer that utilizes only a quasi-stationary alternating electrical field and in which the field strength is proportional to the distance from a given line, e.g., the z axis. (G.Y.)

6550

MASS SPECTROMETRIC ANALYSIS OF GERMANIUM.

Richard E. Honig. *Anal. Chem.* **25**, 1530-5(1953) Oct.

A mass-spectrometric method, employed in con-

junction with a physical process of impurity enrichment, has yielded semiquantitative analytical results on Ge samples used in transistor work. After a two-stage treatment in a gradient furnace, the enriched sample is vaporized thermally in a mass spectrometer, at temperatures that are raised in suitable steps. As a result, most impurities are separated, in temperature and time, from the bulk Ge. In this fashion, it seems possible to extend instrumental sensitivities from a present mole fraction limit of 10^{-5} to perhaps 10^{-8} . After the sample is completely evaporated, a time integration of ion currents yields concentration estimates, whose accuracy is mainly limited by uncertainties in the ionization cross sections. In analyses made on commercial Ge, small concentrations of the following impurities were found: As, P, Sb, Sn, Pb, Fe, and Cd. Calibration runs that have been made on Ge, Sn, and Pb show that these Group IVB elements evaporate partially in molecular form, while in the case of arsenic the molecular species As_4 and As_2 predominate. (auth)

MATHEMATICS

6551

Los Alamos Scientific Lab.

ON THE ASYMPTOTIC INTEGRATION OF INTEGRAL EQUATIONS. George F. Carrier. [1953] 9p. (AECU-2694)

Solutions are sought for the equation $\lambda \phi(x) = \beta \int_1^x K(\beta|x-t)| \phi(t) dt$. Cases are discussed for several kernels and for β as a large parameter. Specific examples are treated in neutron-diffusion theory. (K.S.)

6552

Forrestal Research Center, Princeton Univ.

ON THE AMOUNT OF VARIATION OF THE SOLUTION OF A DIFFERENCE EQUATION. [PROJECT MATTERHORN] Martin Kruskal. Oct. 2, 1951. 8p. (NYO-996; PM-S-3(app.))

6553

CONFORMAL TRANSFORMATIONS IN WAVE MECHANICS. Robert Faure. *Compt. rend.* **237**, 603-5(1953) Sept. 21. (In French)

The use of conformal transformations is shown to lead to the eigenvalues of certain two-dimensional fields, in particular to the eigenvalues of the two-dimensional oscillator and atom. (G.Y.)

6554

THE FREDHOLM THEORY OF THE S MATRIX. J. Hamilton. *Phys. Rev.* **91**, 1524-6(1953) Sept. 15.

The equation for the interaction representation transformation operator is put into integral form, and the Fredholm theory of integral equations is used to give an explicit expression for the solution. No extension of the circle of convergence of the S matrix seems possible in the general case. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

6555

Los Alamos Scientific Lab.

ON THE DETECTION OF THE FREE NEUTRINO.

F. Reines and C. L. Cowan, Jr. Aug. 6, 1953. Decl. Aug. 24, 1953. 7p. (AECU-3548)

The experiment previously proposed (*Phys. Rev.* **90**, 492-3(1953)) has been initiated, with a Hanford pile as a neutrino source. It appears probable that neutrino detection has been accomplished, and confirmatory work is in progress. (K.S.)

6556

National Bureau of Standards

CALIBRATION OF LANDSVERK 0.2-r MODEL 80 MIDGET

FINGER CHAMBERS WHEN USED WITH LANDSVERK MODEL L-62 CHARGER-READER. F. H. Day. Sept. 25, 1953. 22p. (NBS-2817)

The present report is primarily concerned with the response of Landsverk Model L-80 Midget Chambers used with L-62 charger-reader to x rays and the γ rays of Co^{60} to determine their energy dependence, calibration with different charger-readers, and effect of atmospheric pressure on response. (auth)

6557

Evans Signal Lab., Signal Corps Engineering Labs.
AN INVESTIGATION INTO SCINTILLATION SPECTROSCOPY AND ITS FEASIBILITY FOR ALPHA, BETA AND GAMMA ENERGY DETERMINATIONS. Frank M. Urvinitka. Aug. 26, 1953. 34p. (NP-4873; M-1530)

An investigation into the potentialities of a scintillation spectrometer as a means of measuring α , β , and γ spectra was conducted. The scintillation spectrometer was found to be especially applicable to the determination of γ -ray energies. A spectrometer was constructed for operation over the energy range of approximately 0.5 Mev to 1.5 Mev. Its application to β -energy determinations of the nature under consideration was not found to be feasible. A preliminary investigation indicates favorably toward the application of scintillation spectroscopy to α -energy measurements. (auth)

6558

Technical Associates
TAPLIN DOSIMETER. FINAL REPORT. [May 1953] 14p. (NP-4901)

Results are presented of studies made to aid the development and production of Taplin dosimeters. These studies include: (1) smallest practical size of the reagent ampoules and shock-proof container; (2) cleaning methods to remove impurities in glass tubing that might interfere with the chloroform/dye solution; (3) equipment and methods for filling ampoules; (4) equipment and methods for sealing the glass ampoules without decomposing the chloroform; (5) a still for producing the desired quality and quantity of low-conductivity H_2O ; and (6) a color-grading process and instruments for segregating tubes in which chloroform decomposed during filling procedures. (L.M.T.)

6559

Columbia Univ.
ON THE LOADING OF ELECTRON SENSITIVE NUCLEAR EMULSION. S. Goldhaber, J. C. Bielk, E. M. Frankl, and Gerson Goldhaber. Aug. 1953. 34p. (NYO-6138; CU-14-53-AEC-1019-Chem.)

The "soaking technique" was applied to introduce D_2 in the form of heavy H_2O into electron-sensitive nuclear emulsions. The same technique was also used to increase the H_2 , O_2 , and C concentration of unloaded Ilford-G5 emulsions by soaking in H_2O and glycerin. A method for processing such loaded emulsions so as to record tracks of minimum ionization is described. Processing procedures for the Ilford-G5 2X and 4X gelatin-diluted emulsions are also given. It was found that 1.5 to 2 g of loading material per cm^3 of unloaded emulsion presents the optimum quantity to be introduced into a G5 emulsion. Considerably larger amounts of loading material produce uneven swelling. The H_2 , C, and O_2 to AgBr ratio of an emulsion can be increased by factors of as much as 5, 2.9, and 7.6, respectively, compared with unloaded emulsions. Representative concentrations are for deuterium $\text{C}_\text{D} = 0.13 \text{ g/cm}^3$, hydrogen $\text{C}_\text{H} = 0.089 \text{ g/cm}^3$, carbon $\text{C}_\text{C} = 0.38 \text{ g/cm}^3$, and oxygen $\text{C}_\text{O} = 0.64 \text{ g/cm}^3$. Loaded emulsions swell and get much thicker than the original unloaded emulsions. Modifications of the exposure time according to available particle flux are discussed. (auth)

6560

CALORIMETRIC EVALUATION OF THE ROENTGEN FOR 400 KV. AND 22.5 MEV. ROENTGEN RAYS. J. S. Laughlin, J. W. Beattie, W. J. Henderson, and R. A. Harvey. *Am. J. Roentgenol. Radium Therapy Nuclear Med.* 70, 294-312 (1953) Aug.

A highly sensitive calorimetric method is described for directly determining the energy output of x-ray generators. The importance of distinguishing between intensity and dose is emphasized. Results of measurements on two x-ray generators are presented. The combination of flux measurement and ionization distribution measurement was applied to obtain plots of the energy dose in ergs/g as a function of depth in the irradiated body. It is suggested that the calorimetric method of flux determination which is described can be made the fundamental calibration of the output of x-ray generators, particularly for generators above 1 Mev. (C.H.)

6561

APPLICATION OF A RADIOACTIVE SOURCE FOR RECORDING PURPOSES. A. Bierman. *Rev. Sci. Instr.* 24, 879-80(1953) Sept.

A system is described whereby a β source was used in conjunction with a photographic film for the recording of atmospheric pressure in a cosmic-ray balloon-flight experiment. A stainless steel cylinder containing the β source (Ti^{204}) is floated on the Hg surface in the open arm of a manometer, the β particles emerging through a small side-hole. A photographic film, wrapped in paper, is placed around a rotating cylindrical drum, driven by means of a clock. The open arm of the manometer is placed as close to the rotating cylinder as possible. The blackened area on the film gives a recording of position of the Hg level as a function of time. (L.M.T.)

6562

PHOTOELECTRIC DETECTION OF TRACKS IN THE DIFFUSION CLOUD CHAMBER. D. C. Marshall and D. Brown. *Rev. Sci. Instr.* 24, 881-2(1953) Sept.

Langsdorf, who developed the diffusion cloud chamber, suggested in his paper (*Rev. Sci. Instr.* 10, 91(1939)) that the recording of the tracks might be made automatic by using photoelectric detection. The authors, from experiments made to test this suggestion, have found it quite possible to photograph the tracks of particles in this way and discuss here the technique and some of the factors to be considered to achieve successful operation. (L.M.T.)

6563

THE USE OF GEIGER AND PROPORTIONAL COUNTERS IN X-RAY DIFFRACTION STUDIES. U. W. Arndt. *Atomics* 4, 217-25(1953) Sept.

The requirements of the design and the precautions to be observed in the use of Geiger and proportional counters for the accurate measurement of x-ray intensities are examined. (auth)

6564

SIMPLE METHOD FOR MEASURING THE CONTENT OF RADIOACTIVE SUBSTANCES IN THE ATMOSPHERE. Otto Haxel. *Z. angew. Phys.* 5, 241-2(1953) July. (In German)

Aerosol filters consisting of filter paper containing pulverized asbestos or amber have the property of retaining the radioactive decay products of Ra and Th emanations. This is explained by assuming that the decay products are captured by charged aerosol particles shortly after their formation and are retained with the latter in the filter. The content of radioactive decay products in the air can thus be determined in a simple manner, and, by observation of the decay of activity on the filter, conclusions can be drawn concerning the nature of the radioactive substances present.

Results of a sample measurement reveal the presence of $\text{ThB} + \text{C}$ (Pb^{212} and Bi^{212}) and $\text{RaB} + \text{C}$ (Pb^{214} and Bi^{214}). (G.Y.)

- 6565
A SCINTILLATION COUNTER FOR THE MEASUREMENT OF WEAK β RAYS. Jean-Claude Roucaÿrol. *Science* **118**, 493(1953) Oct. 23.

A liquid-scintillator counter for C^{14} or T β rays that has been in use for several months is described briefly. The assembly consists of a movable brass chassis in a light-tight brass box. The chassis is provided with a plywood receptacle into which a brass container with Pyrex or quartz faces can be fitted. In the off position the container can be removed or replaced with no light falling on the photomultiplier tubes. In the on position, only coincidence pulses are measured by the two photomultiplier tubes. The container is made liquid-tight with Teflon gaskets, and good optical transmission is obtained by attaching a polished, shaped lucite disk to the tube head of the photomultiplier. (G.Y.)

- 6566
NEUTRON DOSIMETRY. Bernhard Hess. *Z. angew. Phys.* **5**, 297-302(1953) Aug. (In German)

The nature of the neutron dose unit is discussed, and two neutron dosimeters are described. These consist of ionization chambers with cellophane partitions arranged in a condenser-like pattern. Associated γ radiation is compensated for by one or two ionization spaces with Al walls. Tolerance dose measurements can be made with these neutron dosimeters. Neutron- and γ -dose distributions measured in the immediate area of the Paris cyclotron are reported. (G.Y.)

- 6567
SCINTILLATION RESPONSE OF ORGANIC PHOSPHORS. G. T. Wright. *Phys. Rev.* **91**, 1282-3(1953) Sept. 1.

The scintillation efficiency of organic phosphors is studied, a monomolecular and bimolecular quenching process being assumed. Good theoretical agreement is obtained by comparison with experiments on anthracene. Preliminary considerations are given to the problem of the difference in fluorescent-decay times between quanta and particle excitation. (K.S.)

- 6568
MATERIAL TESTING WITH GAMMA AND BETA RAYS. III. SPECIFICATION OF EXPOSURE CONDITIONS FOR GAMMA RADIOGRAPHY. E. A. W. Müller. *Arch. tech. Messen*, 187-90(1953) Aug. (In German)

Graphs of exposure times for various photographic films, for various thicknesses of steel, and for Ra, Co^{60} , Ir^{192} , and Ta^{182} sources of various strengths are presented, together with a discussion of geometry factors in γ radiography. Similar curves also are given for the radiography of Al with a Tm^{170} γ source. 30 references. (G.Y.)

- 6569
CHERENKOV EFFECT IN VAPORS. A. Ascoli Balzanelli and R. Ascoli. *Nuovo cimento* (9) **10**, 1345-6(1953) Sept. 1. (In Italian)

In a preliminary experiment, Cherenkov radiation produced by cosmic rays was detected from a gaseous mixture of air and chloroform. Despite the low intensity of the radiation produced, experiments are continuing with the hope of developing a method of distinguishing particles having velocities near that of light. (G.Y.)

- 6570
USE OF AN ACETYLENE-FILLED COUNTER FOR NATURAL RADIOCARBON. A. R. Crathorn. *Nature* **172**, 632-3(1953) Oct. 3.

A proportional counter for age determination of archeological materials is described. The volume of the mild-

steel container is ~ 3 l, so that 3 g of carbon can be introduced by filling to 1 atm with acetylene. The counter is surrounded by 11 Geiger counters used in anticoincidence, and the whole array is enclosed in a 4-in.-thick Pb shield. The sample counter is operated in the proportional region; thus, a further reduction in background is obtained by discriminating against small pulses. A C^{14} -counting efficiency of 75% is obtained at optimum discriminator setting. (G.Y.)

- 6571
A LOW-COST PLASTIC SCINTILLATOR. George E. Pugh. *Rev. Sci. Instr.* **24**, 878-9(1953) Sept.

It was found that upon the addition of a mixture of 1 to 2% p-terphenyl and 0.02 to 0.05% pure white tetraphenyl butadiene to polystyrene in the regular Polaroid Corp. polymerization process, a product resulted which was day-light-fluorescent, stable under machining, water-clear, and gave pulse heights about 70% as high as the best laboratory samples. The scintillator had a high index of refraction which, combined with the glassy surfaces, provided reliable internal reflection and enabled collection of $\frac{2}{3}$ of the light at the edges of large thin sheets. Its properties are compared with those of some commercial plastic scintillators. (L.M.T.)

- 6572
NUCLEAR EMULSION METHOD FOR ENERGY MEASUREMENT OF INELASTICALLY SCATTERED NEUTRONS. S. C. Snowdon, M. A. Rothman, D. W. Kent, Jr., and W. D. Whitehead. *Rev. Sci. Instr.* **24**, 876-7(1953) Sept.

In the nuclear-emulsion measurement of inelastically scattered neutrons, two defects must be overcome, namely, (1) the low intensity of incident flux, and (2) proton recoils from the bombarding as well as the scattered neutrons. Since the incident flux cannot be increased appreciably, the scatterer geometry must be arranged so that many scattering points give similar contributions to the proton-recoil spectrum. To prevent the direct neutron flux from producing proton recoils, the plane of the emulsion must be placed at right angles to the incident flux. Both of these conditions are met if the scattering material is placed in an axially symmetric ring and the photographic emulsion is located on the axis with its plane in the central plane of the ring. (L.M.T.)

MESONS

- 6573
New York Univ.
FINAL STATUS REPORT. I. ON THE POSITIVE EXCESS OF COSMIC RAY μ -MESONS. II. RADIATIVE BOHR ORBIT TRANSITIONS OF STOPPED NEGATIVE μ -MESONS. III. FUTURE RESEARCH. APP. A AND B. H. A. Morewitz, M. H. Shamos, and A. Fafarman. May 31, 1953. 41p. (AECU-2878)

Part I of this report is a re-evaluation of material previously reported and is abstracted as NSA 6-5433. The results of previous experiments designed to investigate the electromagnetic nature of μ^- -K-orbit interactions have been reported (*Phys. Rev.* **90**, 493(1953)). Part II is largely concerned with the experimental equipment design and counter geometries which were tried in order to reduce the background-to-forward count ratio. Part III outlines exploratory research investigations on cosmic-ray γ radiation, μ -meson interactions, low energy μ -meson spectra, and the neutron component of cosmic radiation. The advantages of scintillation-type detectors are discussed in relation to these studies. (K.S.)

- 6574
Brookhaven National Lab.
A THEOREM ON PHOTO-MESON PRODUCTION NEAR

THRESHOLD AND THE SUPPRESSION OF PAIRS IN PSEUDOSCALAR MESON THEORY. Norman M. Kroll and Malvin A. Ruderman. [Summer 1953] 22p. (BNL-1552)

It is shown that the photoproduction of charged pseudoscalar mesons at threshold, computed to lowest order in the meson-nucleon mass ratio but to arbitrary order in the meson-nucleon coupling constant, is essentially equivalent to the weak-coupling result obtained from second-order perturbation theory. The μ/M corrections can be estimated from the ratio of the positive to the negative production cross section. (auth)

6575

Stanford Univ.

PHOTOPRODUCTION OF π -MESON PAIRS. R. D. Lawson. Aug. 27, 1953. 25p. (NP-4877; Tech. Report 3)

A perturbation study of the photoproduction of π -meson pairs by γ rays incident on protons is made for both pseudoscalar and pseudovector coupling. Expressions are derived for the possible cross sections by assuming the nucleon to be infinitely heavy. The effect of first-order nucleon recoil on the (π^+, π^-) cross section, by assuming pseudoscalar coupling, is considered. Curves illustrating the results are given. The possibility of obtaining information on the type of interaction operative between mesons and nucleons from a study of the pair-production cross sections is discussed. (auth)

6576

THE VARIATION OF THE RATIO OF POSITIVE TO NEGATIVE COSMIC-RAY μ MESONS WITH MOMENTUM AND ALTITUDE. H. A. Morewitz and M. H. Shamos. Phys. Rev. 92, 134-44(1953) Oct. 1.

The mean lifetimes of μ^+ mesons in C and S have been measured by the delayed-coincidence technique. Data for decay times $> 2\mu\text{sec}$ were analyzed by the statistical method of Peierls and yield $\tau_{\pi^+} = 2.09 \pm 0.05 \mu\text{sec}$ for the mean life of the μ^+ meson in sulfur and $\tau_{\pi^+} = 1.92 \pm 0.04 \mu\text{sec}$ for the mean lifetime of the μ^+ meson in C. τ_{π^+} compares favorably with values found in material of low atomic number, but there appears to be a significant difference between these values and those obtained in high Z materials. Assuming a Z^4 -dependent capture probability for μ^- mesons, τ_{π^-} is compatible with other lifetimes determined in materials of higher Z. The integral time distributions of the delayed coincidences obtained above were extrapolated to zero delay time and allowance made for those μ^- mesons which are captured in C. These data were used to obtain the μ^+/μ^- ratio at a momentum of $325 \pm 70 \text{ Mev/c}$ at sea level: $\mu^+/\mu^- = 1.06 \pm 0.03$. This ratio is compared with other experiments (which also provide good identification of the μ mesons) by plotting all ratios as a function of momentum at the top of the atmosphere (TOA). The best fit to the experimental points is given by the exponential expression

where $P = P_0 \exp [\mu^+/\mu^-/K]$,

$P < 4 \text{ Bev/c}$ (TOA), $P_0 \approx 0.165 \text{ Bev/c}$ (TOA), and $K \approx 0.38$. The decrease of the μ^+/μ^- ratio with increasing altitude appears to be well established, although the exact values of P_0 and K are uncertain. (auth)

6577

PIONS FROM PRODUCTION OF BARYONS BY PROTONS. Frederik J. Belinfante. Phys. Rev. 92, 145-52(1953) Oct. 1.

When matter is bombarded by very high-energy nucleons, over 600 Mev in the laboratory system, part of the pions produced may be decay products of excited nucleons of ordinary spin and isobaric spin $3/2$ ("baryons") produced by the incident nucleons. By assuming charge independence, the ratios of the cross sections for various possible processes creating one or more pions are discussed. (auth)

6578

DISINTEGRATION IN MOTION OF A HEAVY PARTICLE. M. Ceccarelli and M. Merlin. Nuovo cimento (9) 10, 1207-9(1953) Aug. 1. (In Italian)

An event observed in nuclear emulsion exposed at 26,000 m altitude is interpreted as the production and decay in flight of a particle heavier than a nucleon. The decay is interpreted as the reaction $\Omega^+ \rightarrow \pi^+ + N^0 + 131 \pm 24 \text{ Mev}$. (G.Y.)

6579

PARTICLES OF COSMIC RADIATION. C. F. Powell. Nature 172, 477-9(1953) Sept. 12.

An international conference on cosmic radiation, organized by the Univ. of Toulouse and under the patronage of the International Union of Pure and Applied Physics, was held at Bagnères de Bigorre during July 6 to 12, 1953. The discussion in the main sessions was limited to the narrow but important field of V particles and heavy mesons. Evidence presented for particles heavier than the proton and for charged and neutral heavy mesons is summarized, and their properties and relationships are discussed. (G.Y.)

6580

SCATTERING OF π -MESONS BY NUCLEONS. V. P. Silin and V. Ya. Fainberg. Uspekhi Fiz. Nauk 50, 325-64(1953) July. (In Russian)

The accumulated results of experimental work on scattering of π -mesons by H_2 and D_2 are discussed. Correlation of the scattering results in a theory of isotopic spin. The general theory of π -meson scattering by nucleons and the experimental data are interpreted. The theory of weak and strong bonds in the interaction of π -mesons and nucleons is presented. 53 references. (J.S.R.)

6581

POSITIVE π -MESON PRODUCTION BY NEGATIVE π MESONS. W. F. Fry. Phys. Rev. 91, 1576-7(1953) Sept. 15.

A stack of Ilford G-5, 600- and 1000- μ -thick plates was exposed in the 220-Mev negative π -meson beam of the University of Chicago cyclotron. In two cases the π -meson track from the π - μ decay originated from a high-energy meson interaction. One event is interpreted as the inelastic scattering of a π^- meson with the production of a π^+ meson, $\pi^- + p$ (in nucleus) $\rightarrow \pi^- + n + \pi^+$. There is no evidence for the formation of a ξ^0 meson. The other event is interpreted as the production of a π^+ meson by a π^- meson by a double charge-exchange reaction: $\pi^- + p$ (in a nucleus) $\rightarrow \pi^0 + n$, $\pi^0 + p$ (in the same nucleus) $\rightarrow \pi^+ + n$. A very crude estimate of the probability per nuclear interaction of π^+ -meson production by π^- mesons, made from the number of π^- meson stars and π - μ decays, is $\sim 4 \times 10^{-4}$. (G. Y.)

6582

TRANSITION EFFECT FOR SLOW MESONS. A. O. Vaisenberg. Doklady Akad. Nauk S.S.S.R. 91, 483-5(1953) July 21. (In Russian)

If the formation of slow mesons by proton-neutron reaction has significant intensity, a noticeable transition effect is detectable by placing a slow-meson absorber over the detector. The arrangement used to detect the disintegration is described. Graphite was used as the meson generator. The number of transitions reach a maximum with 19.2 g/cm^2 of absorber. (J.S.R.)

6583

HEAVY MESONS. A. I. Alikhanov. Uspekhi Fiz. Nauk 50, 481-538(1953) Aug. (In Russian)

A review is presented of the detection and measurement, properties, and origin of heavy mesons. 37 references. (J.S.R.)

6584

TWO TYPES OF CHARGE SYMMETRY. A. Baldin and V. Mikkailov. Doklady Akad. Nauk S.S.S.R. 91, 479-82(1953) July 21. (In Russian)

The photoproduction of π^0 , $\gamma + d = d + \pi^0$ and $\gamma + d = n + p + \pi^0$, is analyzed for charge symmetry. A generalized form is developed from the group properties of the wave function and the Hamiltonian invariance of charge space in the group type D_∞ . (J.S.R.)

METEOROLOGY

6585

Argonne National Lab.

SUMMARY OF METEOROLOGICAL DATA TAKEN AT ARGONNE NATIONAL LABORATORY, DU PAGE COUNTY, ILLINOIS, JULY 1951 THROUGH JUNE 1952. Feb. 1953. 121p. (ANL-4928)

Climatological studies made at various locations on the Argonne site during the year are summarized. Joint frequency distributions of temperature lapse rate vs. wind ratio, temperature lapse rate vs. wind speed, and wind ratio vs. wind speed are included. A description of the meteorological instruments used to obtain the data summarized in the report is given. (J.E.D.)

MICROWAVES

6586

Columbia Radiation Lab., Columbia Univ.

QUARTERLY PROGRESS REPORT, [APRIL THRU JUNE, 1953]. June 30, 1953. 44p. (CU-2-53-SC-42519-Phys; Quarterly Progress Report 2)

Further progress is reported on the design and operation of high-power magnetrons in the millimeter wavelength region. A technique is described for determining magnetron harmonic generation. New measurements are reported on the $2^2S_{1/2}$ -shift of ionized He. Microwave spectral lines are given for CsBr, CsI, RbBr, RbI, and NaI. Frequency stabilization of a microwave spectrometer is described. Values for the molecular quadrupole coupling constants of S^{33} have been determined. The microwave spectrum of DI is reported at 1.5 mm wavelength. (For preceding period see NP-4631.) (K.S.)

MOLECULAR PROPERTIES

6587

Los Alamos Scientific Lab.

FURTHER RESULTS ON MONTE CARLO EQUATIONS OF STATE. Marshall N. Rosenbluth and Arianna W. Rosenbluth. [1953?] 13p. (AECU-2651)

In a previous article (J. Chem. Phys. 21, 1087(1953); NSA 7-2599) the Monte Carlo method for investigating such properties as equations of state of individual molecules was described, and some results were presented. Further results are presented for a two-dimensional system of molecules with Lennard-Jones interaction and the equation of state for three-dimensional rigid spheres. (L.M.T.)

6588

Duke Univ.

QUARTERLY PROGRESS REPORT. MAY 1, 1953 [TO] AUGUST 1, 1953. [CONSISTS OF:] MICROWAVE SPECTRA AND STRUCTURES OF METHYL MERCURY CHLORIDE AND BROMIDE. Walter Gordy and John Sheridan. ONE-TO-TWO MILLIMETER SPECTROSCOPY. PART II. H_2S . Charles A. Burrus, Jr. and Walter Gordy. 52p. (NP-4841; Report 2)

Microwave Spectra and Structures of Methyl Mercury Chloride and Bromide. Walter Gordy and John Sheridan. From the pure rotational spectra of several different isotopic species of CH_3HgCl it is shown that $d_{CHg} = 2.061 \pm 0.02$ A, $d_{HgCl} = 2.282 \pm 0.005$ A, and $\angle CHgCl = 180^\circ$. Similarly, for CH_3HgBr it is shown that $d_{CHg} = 2.074 \pm 0.015$ A, $d_{HgBr} = 2.406 \pm 0.005$ A, and $\angle CHgBr = 180^\circ$.

Nuclear quadrupole couplings evaluated are $Cl^{35} = -42$ Mc, $Cl^{37} = -33$ Mc in CH_3HgCl , and $Br^{79} = 350$ Mc, $Br^{81} = 290$ Mc in CH_3HgBr . These indicate ionic character of 62% for the $HgCl$ and 55% for the $HgBr$ bond in these molecules, and lead to a value of 1.7 to 1.8 for the electronegativity of divalent Hg. One-To-Two Millimeter-Wave Spectroscopy. Part II. H_2S . Charles A. Burrus, Jr. and Walter Gordy. Pure rotational transitions of H_2S^{32} , H_2S^{33} , and H_2S^{34} have been measured with high precision in the region of one to two mm. From these measurements the SH bond length is found to be 1.3226 A and the bond angle to be $92^\circ 6'$. The S^{33} nuclear quadrupole coupling observed along the principal inertial axes are $eQq_{aa} = -32$ Mc, $eQq_{bb} = -8$ Mc, and $eQq_{cc} = +40$ Mc. Approximate analysis of the quadrupole coupling constants shows that the bonding orbitals of S are spd hybrids and yields a value of -0.06×10^{-24} cm² for the quadrupole moment of the S^{33} nucleus. From the known ratio Q^{33}/Q^{35} this gives $Q^{35} = 0.04 \times 10^{-24}$ cm². Zeeman studies show that the molecular g_J factor is approximately, but not exactly, equal for different rotational states. A mean value of 0.24 nuclear magnetons is found for g_J . (auth)

6589

ATOMIC THEORY OF LIQUID HELIUM NEAR ABSOLUTE ZERO. R. P. Feynman. Phys. Rev. 91, 1301-8(1953) Sept. 15.

The properties of liquid He at very low temperatures (below 0.5°K) are discussed from the atomic point of view. It is argued that the lowest states are compressional waves (phonons). Long-range motions which leave density unaltered (stirrings) are impossible for Bose statistics since they simply permute the atoms. Motions on an atomic scale are possible but require a minimum energy of excitation. Therefore, at low temperature the specific heat varies as T^3 , and the flow resistance of the fluid is small. The arguments are entirely qualitative—no calculation of the energy of excitation nor of the low-temperature viscosity is given. In an appendix an expression, previously given, for the partition function is modified to include the effects of phonons. (auth)

6590

ATOMIC THEORY OF THE λ TRANSITION IN HELIUM.

R. P. Feynman. Phys. Rev. 91, 1291-1300(1953) Sept. 15.

It is shown from first principles that, in spite of the large interatomic forces, liquid He^4 should exhibit a transition analogous to the transition in an ideal Bose-Einstein gas. The exact partition function is written as an integral over trajectories, using the space-time approach to quantum mechanics. It is next argued that the motion of one atom through the others is not opposed by a potential barrier because the others may move out of the way. This just increases the effective inertia of the moving atom. This permits a simpler form to be written for the partition function. A rough analysis of this form shows the existence of a transition, but of the third order. It is possible that a more complete analysis would show that the transition implied by the simplified partition function is actually like the experimental one. (auth)

NEUTRONS

6591

NEUTRONS AND POSITRONS. Ernesto E. Galloni. Univ. Buenos Aires, Fac. cienc. exact. fis. y nat., Contribs. cient., Ser. B: Fis. 1, 59-145(1950). (In Spanish)

A general review on the production, detection, absorption, diffusion, and diffraction of neutrons and on the behavior of positrons in matter and magnetic and electric fields is presented. (G.Y.)

NUCLEAR PHYSICS

6592

Atomic Energy Research Establishment, Harwell, Berks (England)
A NUCLEAR PHYSICS TRAINING MANUAL. K. J. Bobin.
Dec. 16, 1948. 104p. (AERE-N/M-11D)

6593

ISOTOPIC SPIN SELECTION RULES. D. H. Wilkinson.
Nature 172, 576-80(1953) Sept. 26.

The nature of isotopic spin; selection rules in nuclear interactions, β decay, and photodisintegration; and purity of isotopic spin states are discussed critically. 49 references. (G.Y.)

6594

STRUCTURE OF THE ATOMIC NUCLEUS. *Nature* 172, 486(1953) Sept. 12.

About 300 nuclear physicists, 120 of them from overseas, met at the Univ. of Birmingham, England, during July 13 to 18, 1953, for discussions on nuclear structure. An account of a few of the topics actually discussed, namely, nuclear models, nuclear radii, and interactions with electron shells, is presented. (G.Y.)

6595

ON THE LOCALIZABILITY OF PARTICLES IN THE NUCLEI AND IN THE ELECTRON CORTEGE OF ATOMS AND MOLECULES. Raymond Daudel. *Compt. rend.* 237, 801-3 (1953) Sept. 21. (In French)

By investigating the problem of localizing a particle in a system with which a wave function is associated, the author makes more precise the geometrical significance of the hypothesis of shells in nuclei and their associated electrons, as well as the nature of the chemical bond in molecules. (tr-auth)

6596

THEORY OF NUCLEAR FORCES. José Leite Lopes. *Univ. Buenos Aires, Fac. cienc. exact. fis. y nat., Contr. cient., Ser. B: Fis. I*, 1-58(1950). (In Portuguese)

An attempt is made to relate available information on nucleon-nucleon collisions, meson-nucleon interactions, and decay of cosmic mesons to the meson-field theory of nuclear forces. This paper was first presented before a meeting of the Asociación Física Argentina on May 22 to 25, 1948. (G.Y.)

6597

NEUTRINO CHARGING OF ELEMENTARY PARTICLES. Ya. B. Zel'dovich. *Doklady Akad. Nauk S.S.S.R.* 91, 1317-20(1953) Aug. 21. (In Russian)

It is shown that elementary particles can be characterized by "neutrino charging." The conservation of the electric charge and number of nucleons during all processes of particle transformation is defined as "neutrino charge." This charge of μ^- -mesons and electrons reduces to the unique selection rule. Only pairs of particles will originate from transformation reactions, as $\nu + \bar{\nu}$, and not $\nu + \nu$ or $\bar{\nu} + \bar{\nu}$. The proof of these statements is developed by the Lagrangian system. (J.S.R.)

6598

MANY-NUCLEON FORCES. Gregor Wentzel. *Phys. Rev.* 91, 1573-4(1953) Sept. 15.

In pseudoscalar meson theory (PS coupling) the saturation character of nuclear forces is accounted for by the cooperative action of many-body forces. These nuclear interactions result mainly from matrix elements describing virtual nucleon-pair creation and annihilation processes and can also be derived easily from the equivalent (pseudo-) scalar pair theory, if a nonrelativistic treatment of the nucleons is used and a cutoff in the interaction with high-energy mesons is adopted. A short derivation of the many-body potentials from the scalar pair theory is outlined, and the approximations involved are pointed out. (G.Y.)

NUCLEAR PROPERTIES

6599

Radiation Lab., Univ. of Calif., Berkeley
VARIATION OF NEUTRON TOTAL CROSS SECTION OF BISMUTH AND URANIUM BETWEEN 45 AND 160 MEV (thesis). William I. Linlor. July 30, 1953, declassified Oct. 2, 1953. 94p. (AEC-D-3478; UCRL-2303)

The variation of neutron total cross section with energy of Bi and U between 45 and 160 Mev has been measured with a time-of-flight instrumentation in a good geometry transmission experiment. Bi shows a dip in cross section to 4.14 ± 0.14 b at 62 Mev, followed by a rise to 4.92 ± 0.12 b at 70 Mev. U shows a dip in cross section to 4.53 ± 0.17 b at 62 Mev, followed by a rise to 5.30 ± 0.15 b at 70 Mev. The points for both Bi and U show the same general variation with energy as the data first obtained by Taylor and Wood for Pb. Variation of neutron total cross section with energy for C also was measured with the same instrumentation as a check. The results agree well with values published by others. As part of the data, the direct-beam neutron spectrum has been measured, it seems to agree with the theoretical curve given by Serber for an "opaque-nucleus" model with 195-Mev deuterons being stripped on a "thin" target. (auth)

6600

Brookhaven National Lab.

FORMATION OF THE LONG-LIVED Bi^{210} ISOMER.

D. J. Hughes and H. Palevsky. [1953] 22p. (BNL-1542)

The thermal activation cross section of Bi^{209} is shown to be definitely less than the absorption cross section, 19 ± 2 mb compared to 33 ± 2 mb. In order to verify the high absorption value previously obtained by pile reactivity methods, measurements were made with the long-wavelength neutrons available with the Brookhaven slow chopper. The absorption cross section is obtained from the chopper measurements by subtraction of thermal inelastic scattering. The latter scattering is determined from the variation of measured scattering with sample temperature. The difference between the absorption and scattering (14 ± 3 mb) is ascribed to the formation of the long-lived α -emitting isomeric state of Bi^{210} , leading to a half-life of $2.6 \pm 0.8 \times 10^6$ years. This long life is in agreement with the expected properties, relative to α and β decay, of a high-spin state of Bi^{210} . (auth)

6601

ISOTOPE SHIFT ANOMALIES AND NUCLEAR STRUCTURE.

Lawrence Wilets, David L. Hill, and Kenneth W. Ford.

Phys. Rev. 91, 1488-500(1953) Sept. 15.

When observed isotope shifts in the electronic spectra of the heavy elements have been corrected for electronic structure, the resulting shifts give new insight into nuclear structure. In comparison with the shifts predicted for constant-density spherical nuclei, the reduced observed shifts are anomalous (1) in magnitude, being on the average too small by a factor 0.5, (2) in trend with neutron number, showing an oscillation in magnitude, and (3) in the staggering of shifts between even and odd isotopes. The present work shows that the anomaly in magnitude largely disappears when account is taken of the compressibility and polarizability of nuclear matter, as a result of which the nuclear radius is found to vary less rapidly with change in neutron number than is predicted by the average $A^{1/3}$ law. The analysis of experimental data also suggests that nuclear particle density variations are slightly greater than indicated by earlier theoretical estimates. Likewise, the oscillatory trend in isotope shifts ceases to appear anomalous when associated with the regular progression in nuclear shapes as derived from configuration theory, from the analysis of quadrupole moments and the first excited

states of even-even nuclei, and from other sources. The general size of the amplitude and the nodal positions of the shift variation are consistent with expectations. Finally, the even-odd staggering in isotope shifts is reasonably to be connected with the staggering to be expected in the progression of nuclear deformations through odd and even isotopes. Thus the over-all pattern of isotope shifts appears to fit together with present ideas and to provide new specific information on nuclear structure. (auth)

6602

THE PAIRING EFFECT IN NUCLEI AND ISOMERISM.

Robert Katz. *Phys. Rev.* **91**, 1487(1953) Sept. 15.

Previous workers have shown from an analysis of the energetics of α and β decay that the pairing energy of protons is greater than that of neutrons. It is here postulated that this effect is responsible for the absence of odd-proton isomers for $50 < Z < 82$. (auth)

6603

MANY-BODY FORCES AND NUCLEAR SATURATION.

S. D. Drell and Kerson Huang. *Phys. Rev.* **91**, 1527-42 (1953) Sept. 15.

Nuclear saturation is studied with many-body interactions derived from pseudoscalar meson theory with pseudoscalar coupling. All parameters appearing in this calculation are fixed on the basis of the work of Lévy, who has shown that leading terms in a perturbation deduction of the two-body interaction are well fitted to reproduce the experimental data. The leading term in the n -body potential depends only on the interparticle distances and is repulsive (attractive) for n odd (even). The energy of the nucleus is calculated with potentials up through five-body interactions and with neglect of Coulomb and surface effects. Saturation properties derived from these considerations are in accord with experience. Antisymmetrization of the nuclear wave function reduces the many-body interaction energies considerably by inhibiting the close approach of many particles. Thus the Pauli exchange terms are found to reduce the five-body interaction energy by 76% and to give a rapid convergence for the expansion in n -body forces. (auth)

6604

NUCLEAR MOMENTS. B. T. Fel'd. *Uspekhi Fiz. Nauk* **50**, 602-26(1953) Aug. (In Russian)

The methods of measuring nuclear moments—angular distribution of products of nuclear disintegration, β spectroscopy, and properties of isomeric transitions—are discussed in detail. The model of free particles and nuclear moments are reviewed. 178 references. (J.S.R.)

5605

APPLICATION OF ELECTRON MULTIPLICATION TO CALCULATION OF ELEMENTARY PARTICLES AND QUANTA. T. M. Lifshits. *Uspekhi Fiz. Nauk* **50**, 365-432(1953) July. (In Russian)

A review is presented for the application of electron multiplication to the calculation of elementary particles and quanta. Some characteristic increases are shown, and the methods of recording and investigating different forms of emission are discussed. 149 references. (J.S.R.)

B606

THE $C^{12}H-C^{13}$ DOUBLET. Heinz Ewald. *Z. Naturforsch.* **a8**, 447(1953) July. (In German)

The mass difference of the $C^{12}H-C^{13}$ doublet has been measured as 4.49 ± 0.01 m_{amu} , giving the value 13.00745 ± 0.00001 amu for the mass of C^{13} . (G.Y.)

6607

THE NUCLEAR MAGNETIC MOMENT OF Cr^{53} AND Sr^{87} . C. D. Jeffries and P. B. Sogo. *Phys. Rev.* **91**, 1286(1953) Sept. 1.

Experiments are described for determining the nuclear magnetic moments of Cr^{53} and Sr^{87} . Values obtained, with-

out diamagnetic correction, were $\mu(Cr^{53}) = -(0.4735 \pm 0.00007)$ and $\mu(Sr^{87}) = -(1.0892 \pm 0.00015)$ nuclear magnetons. (K.S.)

6608

APPLICATION OF THE jj -COUPLING MODEL TO MODERATELY LIGHT NUCLEI. Dieter Kurath. *Phys. Rev.* **91**, 1430-47(1953) Sept. 15.

An investigation based on the strong spin-orbit coupling model is made for nuclei in the $1d_{3/2}$ and $1f_{7/2}$ shells. Hartree-Fock wave functions and central forces are used in calculating ground-state spins and binding energy differences. Coupling rules are found for configurations of identical nucleons and for the simplest odd-odd nuclei. Approximate wave functions are constructed for odd- A and even-even nuclei having both neutrons and protons in the $1f_{7/2}$ shell. Binding-energy differences, magnetic moments, and β -decay matrix elements are calculated with these functions. The result of comparing binding-energy differences with experiment is interpreted as favoring strong spin-orbit coupling over weak spin-orbit coupling. (auth)

5509

EFFECTIVE NUCLEAR CHARGES FOR ATOMS FROM SELF-CONSISTENT FIELD CALCULATIONS. A. J. Freeman. *Phys. Rev.* **91**, 1410-17(1953) Sept. 15.

Results of calculations of $2Z_p$, the effective nuclear charge for the potential in an atom, are reported for those atoms treated by self-consistent field methods. Tables of the effective nuclear charges are given for atoms in various degrees of ionization. (auth)

6610

THE QUADRUPOLE MOMENTS OF Sb^{121} AND Sb^{123} .

G. Sprague and D. H. Tomboullian. *Phys. Rev.* **92**, 105-8 (1953) Oct. 1.

An extension of the existing term analysis of the spectrum of Sb II has led to the reliable identification of lines which are known to exhibit well-resolved hfs patterns. Among the few such lines which reveal a simple pattern are the three transitions whose wavelengths in angstroms are 5057, 5895, and 6806. On the basis of the measurements of the hfs separations of these lines, it has been possible to arrive at values of the nuclear electric quadrupole moments of Sb^{123} and Sb^{121} from a study of the splitting of the $5s5p^3\ ^3P_1$, $5p6s\ ^3P_1$, and $5p6p\ ^3D_1$ states. By utilizing the recent value of the quadrupole-moment ratio as determined by microwave techniques, corrections have been applied for the perturbing effects of unassigned nearby levels. The present calculations yield the following results for the quadrupole moments of the two isotopes: $Q_{121} = -1.3 \times 10^{-24}$ cm^2 and $Q_{123} = -1.7 \times 10^{-24}$ cm^2 . (auth)

6611

THE ENERGY LEVELS OF ODD-ODD NUCLEI. A. de-Shalit. *Phys. Rev.* **91**, 1479-86(1953) Sept. 15.

A derivation of a closed formula for the energy levels of odd-odd nuclei is described, and the plausibility of the Nordheim rule is discussed. (auth)

6612

RESEARCH IN NUCLEAR MAGNETISM. E. M. Purcell. *Science* **118**, 431-6(1953) Oct. 16.

The speech presented by the author on his receipt of the Nobel Prize award for 1952 is reprinted. Various investigations involving nuclear induction and the magnetic properties of nuclei are mentioned. 17 references. (G.Y.)

6613

THE PRINCIPLE OF NUCLEAR INDUCTION. Felix Bloch. *Science* **118**, 425-30(1953) Oct. 16.

The speech presented by the author on his receipt of the Nobel Prize award for 1952 is reprinted. The history and achievements of nuclear induction methods are summarized. 17 references. (G.Y.)

6614

EVIDENCE FOR A REGION OF EXTRA NUCLEAR STABILITY BETWEEN THE 82- AND 126-NEUTRON SHELLS. Benjamin G. Hogg and Henry E. Duckworth. *Phys. Rev.* **91**, 1289-90(1953) Sept. 1.

The nuclear neutron number is plotted against the millimass difference between the semiempirical mass values of Metropolis and Reitwiesner and the experimental masses. A broad general increase in stability is identified between the 82- and 126-neutron shells. (K.S.)

NUCLEAR REACTORS

6615

Oak Ridge National Lab.

RECALIBRATION OF THE X-10 STANDARD GRAPHITE PILE. E. D. Klema, R. H. Ritchie, and G. McCammon. Issued Oct. 17, 1952. Decl. Aug. 6, 1953. 9p. (AEC-D-3590; ORNL-1398)

The thermal-neutron flux in slot number 11 of the X-10 standard graphite pile was measured by counting the γ rays from activated Au foils with a NaI scintillation counter of known efficiency. (auth)

6616

Hanford Works

DISTRIBUTION OF THERMAL NEUTRONS IN EXPONENTIAL AND SIGMA PILES. G. E. Duvall. June 3, 1953. 16p. (HW-28268)

Solutions of the neutron-diffusion equation are developed in a rather complete fashion for sigma piles. The development is also applicable to exponential piles since the solutions for the two cases are formally identical, the physical difference arising from the interpretation of the diffusion length in the exponential pile. (L.M.T.)

6617

REACTOR SIMULATORS. F. E. O'Meara. *J. Appl. Phys.* **24**, 1200-2(1953) Sept.

Reactor kinetic equations are given, together with the equations for fission-product poisoning and temperature effects. A conceptual design of a reactor simulator is presented, and the numerical values of the coefficients are listed. (auth)

6618

REVIEW OF CERAMIC MATERIAL REQUIREMENTS FOR NUCLEAR REACTOR USE. J. F. White. *Am. Ceram. Soc. Bull.* **32**, 301-5(1953) Sept.

Brief fundamentals on the use of ceramics in nuclear reactors are presented, primarily to stimulate interest in this new field for ceramic material applications. Nuclear and engineering design criteria are briefly described for the five general applications to nuclear reactors: (1) fuels, (2) moderators, (3) controls, (4) structural materials, and (5) shielding. Examples of moderator efficiencies for several elements are also presented to illustrate their nuclear qualifications. (auth)

NUCLEAR TRANSFORMATION

6619

Los Alamos Scientific Lab.

THE FRACTION OF THE MASS 141 CHAIN FORMED INDEPENDENTLY AS La^{141} IN THE THERMAL NEUTRON FISSION OF U^{235} . G. P. Ford and C. W. Stanley. Decl. Aug. 20, 1953. 9p. (AEC-D-3551)

The La-Ce fraction of the mass 141 products produced by thermal fission of U^{235} has been measured. Upper limits of 0.057 and 0.032 were established, basing the chemical yield on the weight of CeO_2 and the activity of Ce^{144} , respectively. From another run, the La-Ce fraction was 0.022 and 0.017, again based on CeO_2 and Ce^{144} , respectively. Results agree with a previous proposal that the most prob-

able nuclear charge for two complementary fission fragments is such that both are equally displaced from stability in the direction of β^- instability. The distribution about the hypothetical most probable charge (not necessarily integral) is the same for all mass chains and for thermal neutron fission of all fissionable nuclides. (K.S.)

6620

Los Alamos Scientific Lab.

CROSS SECTIONS FOR THE $\text{O}^{16}(\text{n,p})\text{N}^{16}$ REACTION FROM 12 TO 18 MEV. H. C. Martin. [1953] 6p. (AECU-2373)

Cross sections for the $\text{O}^{16}(\text{n,p})\text{N}^{16}$ reaction have been measured for neutron energies from 12 to 18 Mev. A threshold of 10.0 ± 0.7 Mev was determined from the reported Q value of 9.4 Mev. Neutron energy spreads vary from ± 0.2 Mev at a mean energy of 18 Mev to nearly ± 1 Mev from 12 to 15 Mev. A decrease in the $\text{O}^{16}(\text{n,p})\text{N}^{16}$ cross section above 13.5 Mev is possibly explained by the competitive effect of inelastic scattering. A half life of 7.38 ± 0.05 sec was obtained for the N^{16} activity. (J.A.G.)

6621

Research Foundation, Ohio State Univ.

RESONANCE CAPTURE OF PROTONS BY Mg^{25} . Warren E. Taylor, Leonard N. Russell, and John N. Cooper. [1953?] 12p. (AECU-2743)

Protons from a Van de Graaff generator were used to bombard targets of Mg^{25} . The reaction $\text{Mg}^{25}(\text{p},\gamma)\text{Al}^{26}(\beta^+)\text{Mg}^{26}$ was studied by observing the positron yield as a function of proton energy in the region between 300 and 1200 kev. Resonance peaks occur for protons with energies of 388, 494, 510, 563, 588, 650, 683, 722, 777, 812, 880, 928, 986, 1043, 1081, 1098, 1132, and 1197 kev. The cross section is of the order of 10^{-27} cm² for the stronger resonances. (auth)

6622

Los Alamos Scientific Lab.

EXCITATION FUNCTIONS FOR THE $(\text{n},2\text{n})$ REACTIONS IN Ge, Sc, As, Tl, and Ni. S. J. Bame, Jr. [1953?] 5p. (AECU-2650)

The $(\text{n},2\text{n})$ reaction was studied in Ge^{70} , Sc^{45} , As^{75} , Tl^{203} , and Ni^{58} , with neutrons from the $\text{T}(\text{d},\text{n})\text{He}^4$ reaction. Neutron energies from 12 to 18 Mev were obtained by placing samples at appropriate angles around the T target. Radioactive decay curves were obtained for each sample, from which the activities at a given time were calculated. After correcting for neutron distribution, relative yield curves were obtained. (L.M.T.)

6623

Los Alamos Scientific Lab.

CROSS SECTIONS FOR THE REACTIONS $\text{D}(\text{d,p})\text{T}$, $\text{D}(\text{d,n})\text{He}^3$, $\text{T}(\text{d,n})\text{He}^4$, AND $\text{He}^3(\text{d,p})\text{He}^4$ BELOW 120 KEV. W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. [1953?] 40p. (AECU-2687)

These cross sections were measured by passing a deuteron beam into a thin gas target contained behind a thin window of evaporated SiO . The energy loss in the window was measured by a deceleration technique. Charged particles from the reactions were observed at 90° in the laboratory system with proportional counters. For the reaction $\text{D}(\text{d,p})\text{T}$ and with the angular distribution reported by Wentzel and Whaling (*Phys. Rev.* **88**, 1149(1952)); the total cross section is 15.4 mb with a probable error of 3.2% at 100-kev incident deuteron energy; and $\sigma = 0.629$ mb $\pm 5\%$ at 25 kev. For the reaction $\text{D}(\text{d,n})\text{He}^3$, $\sigma = 15.2$ mb $\pm 3.2\%$ at 100 kev and 0.592 mb $\pm 5\%$ at 25 kev; the sum of these two cross sections follows a Gamow function below 50 kev. For the reaction $\text{T}(\text{d,n})\text{He}^4$ and by assuming isotropy in the center-of-mass system, σ shows a peak value of 4.95 b $\pm 2.8\%$ at 107 kev; at 40 kev, $\sigma = 0.72$ b $\pm 3.2\%$; at 19 kev, $\sigma = 0.045$ b $\pm 5\%$; and below 19 kev, σ follows a Gamow function. For the reaction $\text{He}^3(\text{d,p})\text{He}^4$ and by assuming isotropy, $\sigma = 16$ mb

$\pm 3\%$ at 93 keV; $\sigma = 0.124 \text{ mb} \pm 5\%$ at 36 keV; and σ follows a Gamow relation below 100 keV. (auth)

6624

Radiation Lab., Univ. of Calif., Berkeley
RANGE DISTRIBUTION OF ALPHA PARTICLES FOLLOWING THE DECAYS OF Li^8 AND B^8 . F. C. Gilbert. Aug. 28, 1953. 6p. (UCRL-2328)

An analysis of range distribution of the α tracks resulting from the reactions $\text{B}^8 \rightarrow e^+ + \text{Be}^{8*} \rightarrow 2\text{He}^4$ and $\text{Li}^8 \rightarrow e^- + \text{Be}^{8*} \rightarrow 2\text{He}^4$ is presented. From the results obtained, it is suggested that the B^8 β decay leads to the same energy levels in Be^8 as does the Li^8 β decay. (L.M.T.)

6625

THE THEORY OF COULOMB EXCITATION OF NUCLEI. K. Alder and A. Winther. Phys. Rev. **91**, 1578-9(1953) Sept. 15.

The possibility of exciting nuclear states by the electric field of impinging charged particles has been discussed by several authors. The feasibility of performing experiments of this type has recently been demonstrated, and numerical results are reported of use in the application of theory to interpretation of the experiments. The target is usually bombarded with energies below the Coulomb barrier to ensure that no nuclear interaction takes place. As the excitation probability is small, quantum-mechanical perturbation theory may be used to find the cross section. Particularly well suited for Coulomb excitation are the rotational states in rather heavy nuclei for which the quadrupole components of the nuclear matrix elements are especially big. The yield of γ quanta following the Coulomb excitation provides a measure of the cross section for the excitation. The angular distribution of the γ 's must be considered in this case. (G.Y.)

6626

THE ENERGY SPECTRUM OF PARTICLES FROM STARS. R. W. Waniek and Taiichiro Ohtsuka. Phys. Rev. **91**, 1574-5(1953) Sept. 15.

The range distribution of particles from nuclear stars was observed in Ilford G5 plates, 200 μ thick, exposed to a high-energy neutron beam (~ 90 MeV). The actual range for each prong was determined, and special precautions were taken in determining the shrinkage factor. Detailed spectra are given for the particles from 1-prong to 5-prong stars, for ranges between 5 and 200 μ , and for various spatial angles. (G.Y.)

6627

ENERGY DISTRIBUTION OF α PARTICLES IN NUCLEAR EVAPORATION WITH CONSIDERATION OF FISSION. I. G. Süßmann. Z. Naturforsch. **a8**, 404-16(1953) July. (In German)

The frequent appearance of "too slow" α particles in stars on photographic emulsions is explained as a kinematic effect: a significant number of the highly excited nuclei split into two portions of equal size, and the velocity with which both pieces separate is large enough to distort the energy spectrum of the α tracks strongly, but of the p tracks only slightly. On the basis of the gaseous drop model the time scale for fission is estimated and compared with that for evaporation. (tr-auth)

6628

INELASTICITY IN NUCLEON-NUCLEUS COLLISIONS AT HIGH ENERGIES. P. Budini and G. Polani. Nuovo cimento (9) **10**, 1288-98(1953) Sept. 1. (In Italian)

The purpose of this communication is to establish a method for determining the mean inelasticity factor γ in nuclear collisions at high energy, i.e., the fraction of the energy of the primary which is converted into π mesons. The necessary and sufficient condition for the production of a secondary radiation of a certain spectrum from a primary

radiation of given spectrum is the homogeneity of the elementary cross section. A similar property is valid for the absorption of the primary radiation: if it has a power spectrum and is exponentially absorbed, then the elementary reproduction cross section is of homogeneous type. The behavior of the "N" component suggests that the elementary cross sections of the nuclear cascade for high energies must be, with good approximation, of homogeneous type. The relative lengthening δ of the mean absorption path is found to be proportional to the inelasticity factor γ . This in principle provides a way of determining γ . If one registers the "N" component traversing a dense material (where practically no relativistic π mesons decay) through the primaries of the nuclear collisions (for example with nuclear emulsions) selecting events with neutral (principally neutrons) and charged (principally protons + mesons) primaries, one may obtain an indication of the mean absorption path with and without the contribution of the π mesons. (auth)

6629

CHARGE INDEPENDENCE IN (γ, n) AND (γ, t) REACTIONS. D. C. Peaslee and V. L. Telegdi. Phys. Rev. **92**, 126-7 (1953) Oct. 1.

The comparison of (γ, n) and (γ, t) reactions on light nuclei with $A = 4n + 3$ will give information on charge symmetry vs. charge independence for nuclear forces. If isotopic spin is a good quantum number (charge independence), more individual levels should appear in (γ, n) reactions than in (γ, t) ; those peculiar to (γ, n) have $T = \frac{1}{2}$, the others have $T = \frac{1}{2}$. The one presently measured case of Li^7 favors charge independence. (auth)

6630

EXCITED STATES OF B^{11} AND B^{12} FROM THE REACTIONS $\text{B}^{10}(\text{d}, \text{p})\text{B}^{11}$ AND $\text{B}^{11}(\text{d}, \text{p})\text{B}^{12}$. Mortimer M. Elkind. Phys. Rev. **92**, 127-33(1953) Oct. 1.

Evaporated targets of natural B and enriched B^{10} deposited on thin Formvar films were bombarded with deuterons produced by the MIT-ONR Van de Graaff accelerator. Incident energies from 4.0 to 8.5 MeV were used, and charged particles leaving the target at 90° to the deuteron beam direction were analyzed by a 180° magnetic spectrograph. The studies covered a region of excitation from 7.50 to 11.46 MeV in B^{11} , and from zero to 3.40 MeV in B^{12} . In the case of B^{11} , two new groups have been found in addition to those previously reported. These have excitation energies of 7.987 ± 0.014 and 10.32 ± 0.02 MeV; the former level is paired with the 7.39-MeV level in C^{11} . The width of the 10.32-MeV level is noticeably broad, 54 ± 17 keV, whereas all the other B levels detected in this work had widths less than 10 keV. The new levels in B^{12} found by (d, p) reaction have excitation energies of 1.674 ± 0.011 , 2.618 ± 0.011 , 2.723 ± 0.011 , and 3.383 ± 0.009 MeV. An analysis of the presently known properties of C^{12} levels lying in the excitation region corresponding to the first five levels in B^{12} suggests the possibility that most of these C^{12} levels have a total isotopic spin of 1. (auth)

6631

ENERGY LEVELS IN F^{18} FROM ALPHA-PARTICLE REACTIONS IN NITROGEN. N. P. Heydenburg and G. M. Temmer. Phys. Rev. **92**, 89-92(1953) Oct. 1.

The elastic scattering of α particles in N as a function of the energy between 1.5 and 3.5 MeV at 90° , $125^\circ 16'$, $137^\circ 43'$, and $156^\circ 20'$ (center of mass) and the cross section for the $\text{N}^{14}(\alpha, \text{p})\text{O}^{17}$ reaction at 90° (lab) in the same energy region were examined. Two new resonances at $E_\alpha = 2.935$ MeV and $E_\alpha = 3.140$ MeV correspond to levels in F^{18} at excitation energies of 6.69 and 6.85 MeV, respectively. These same levels were found to emit protons as well, leading to the ground state of O^{17} . The (α, p) reaction has a relative

probability of about 5% for the upper level and 0.3% for the lower level, compared to the elastic scattering. (auth)

6632

MAGNETIC ANALYSIS OF THE $V^{51}(d,p)V^{52}$ REACTION. J. E. Schwager and L. A. Cox. *Phys. Rev.* **92**, 102-4(1953) Oct. 1.

The proton groups from V targets bombarded with 6-Mev deuterons from an electrostatic generator have been analyzed with a 180° magnetic spectrograph. The ground-state Q value for the $V^{51}(d,p)V^{52}$ reaction was found to be 5.072 ± 0.008 Mev. Of the proton groups observed, 23 have been ascribed to V and correspond to excited states in V^{52} between the ground state and an excitation energy of 3.30 Mev. (auth)

6633

THE REACTION $Li^6(\alpha,\gamma)B^{10}$. D. H. Wilkinson and G. A. Jones. *Phys. Rev.* **91**, 1575-6(1953) Sept. 15.

The $Li^6(\alpha,\gamma)B^{10}$ reaction produced by α particles with energies up to 1.5 Mev was studied with particular attention to the energy levels of B^{10} . Measured γ -ray energies are tabulated, and spins and parities are derived for the B^{10} levels. (G.Y.)

6634

$Li^7(\gamma,p)He^6$ CROSS SECTION. B. L. Tucker and E. C. Gregg. *Phys. Rev.* **91**, 1579-80(1953) Sept. 15.

A yield curve for 0.9-sec He^6 from the $Li^7(\gamma,p)He^6$ was obtained by a scintillation counter gated to operate during a betatron's dead time. The cross sections for 10- to 19-Mev photons were derived from the yield curve by the photon-difference method. The cross-section curve is in important disagreement with the results of Titterton and Brinkley (NSA 7-2400), who used nuclear emulsions. The sharp symmetrical maximum observed by the latter at 15.7 Mev is not shown in the present work. (G.Y.)

PARTICLE ACCELERATORS

6635

Radiation Lab., Univ. of Calif., Berkeley
CAVITY DESIGN DATA FOR HIGH ENERGY LINEAR ACCELERATORS. S. W. Kitchen, A. D. Schelberg, B. V. Hill, and R. G. Smits. Dec. 9, 1952. Decl. Sept. 9, 1953. 47p. (AECD-3589; UCRL-2046)

Cavity design data necessary for the design of high-energy resonant linear accelerators includes resonance, transit-time factor, and shunt-impedance information. This report presents such data in dimensionless form for several drift-tube shapes as a function of an arbitrary parameter. The data are contained within the range of $\beta = 0.1$ to $\beta = 0.7$. (auth)

6636

FAR ULTRAVIOLET RADIATION FROM THE CORNELL SYNCHROTRON. P. L. Hartman and D. H. Tomboulion. *Phys. Rev.* **91**, 1577-8(1953) Sept. 15.

The radiation in the soft x-ray region (50 to 500 Å) emitted by transversely accelerated 220- and 310-Mev electrons was studied with a grazing-incidence spectrograph. For the 310-Mev electrons, a strong continuum is present in this region, and there are no marked density variations. When thin metallic foils of Be and Al are introduced into the path of the undispersed radiation, the characteristic 110-Å K and 170-Å $L_{2,3}$ absorption edges of Be and Al, respectively, are strongly recorded in two orders. For the 220-Mev run, the microphotometer trace shows a gradual but definite increase in density, from about 60 Å on, and attains a peak in the vicinity of 170 Å, diminishing gradually towards longer wavelengths. (G.Y.)

RADIATION ABSORPTION AND SCATTERING

6637

Los Alamos Scientific Lab.

THE ENERGY DISTRIBUTION OF SLOWED FISSION FRAGMENTS. J. A. Northrop and J. E. Brolley, Jr. [nd] Decl. Sept. 8, 1953. 3p. (AECD-3547)

The energy spectrum of fission fragments from U^{235} after slowing down by U^{238} and Al absorbers is discussed. (K.S.)

6638

Los Alamos Scientific Lab.

INELASTIC SCATTERING OF PROTONS AND NEUTRONS BY DEUTERONS. R. M. Frank and J. L. Gammel. [1953?] 28p. (AECU-2655)

By assuming that the range of nuclear forces is small compared to the size of the deuteron and the wavelength of the incoming particle ("zero range" approximation) and using something like the impulse approximation, a connection between the cross sections for elastic and inelastic p-d or n-d scattering is derived. The results of this simple theory are compared with available experimental data, and the agreement between the two is much better than the crude assumptions of the theory merit. An interesting consequence of the theory is that the connection between the elastic and inelastic scattering cross sections is independent of the properties of the two-body forces. The elastic scattering cross section depends hardly at all on the exchange properties of the two-body n-p potential (provided it gives the binding energy of the deuteron correctly) and the n-n potential, and the connection suggests that the same is true of the inelastic scattering cross section. This is in disagreement with more elaborate calculations of Bransden and Burhop. (auth)

6639

Los Alamos Scientific Lab.

CROSS SECTIONS FOR PRODUCTION OF In^{115m} , AND Au^{197m} BY INELASTIC SCATTERING OF NEUTRONS. H. C. Martin, B. C. Diven, and R. F. Taschek. [1953] 23p. (AECU-2666)

Cross sections for the reactions $In^{115}(n,n')In^{115m}$ and $Au^{197}(n,n')Au^{197m}$ have been measured from the reaction thresholds to 5.5 Mev. The lowest mean energy for which the In^{115m} excitation was observed was 440 kev with an energy spread of ± 100 kev; the cross section rises to a peak value of 0.36 b at 2.5 Mev. The lowest mean energy for which the Au^{197m} excitation was observed was 420 kev with an energy spread of ± 40 kev; the cross section rises to a peak value of 1.3 b at 2.5 Mev. Both cross sections show irregularities which are evidence of energy levels in the target nuclei. (auth)

6640

Los Alamos Scientific Lab.

ELASTIC SCATTERING OF FAST NEUTRONS BY He^4 . John D. Seagrave. [1953?] 28p. (AECU-2668)

Angular distributions of neutrons scattered by He have been measured at five neutron energies between 2.6 and 14 Mev. A large proportional counter filled with He and Kr was employed, and the distribution in energy of α particles recoiling from collimated neutrons observed. All five distributions are similar and are characterized by strong scattering of the neutrons in the forward direction, a minimum for neutrons scattered near 120° in the center-of-mass system, and a smaller peak for backscattering. The location of the minimum moves forward, and the ratio of differential cross sections $\sigma_{back}/\sigma_{min}$ increases smoothly with increasing neutron energy over the range studied. The observed angular distributions are in good agreement with the distributions predicted from analysis of p- He^4 scattering

and support the large splitting of the P states of He^3 , and the very broad width of the $P_{1/2}$ state. A summary of n- He^4 phase shifts and recent total cross section measurements is given. (auth)

5541

Atomic Energy Research Establishment, Harwell, Berks (England)
SOME APPROXIMATE FORMULAE FOR USE IN NEUTRON SHIELDING. K. T. Spinney. July 1953. 17p. (AERE-T/R-1221)

The general subject of neutron shielding is discussed with special reference to a recent analytic theory due to Holte. Approximate formulas are given for the neutron collision density, as a function of energy and distance, due to a point source in an infinite moderating medium. (auth)

5542

Los Alamos Scientific Lab.
A MONTE CARLO DETERMINATION OF THE ESCAPE FRACTION FOR A SCATTERING SPHERICAL SHELL WITH CENTRAL POINT SOURCE. C. J. Everett, E. D. Cashwell, and O. W. Richard. Aug. 24, 1953. 11p. (LA-1583)

Two types of Monte Carlo procedures were developed for the computation of the fraction of monoenergetic neutrons, emanating from a central point source, which escape from the surface of a hollow spherical shell after any number (≥ 0) of elastic collisions. The shell is composed of heavy nuclei with given elastic and inelastic cross sections and a given differential cross-section curve for elastic scattering angle. Both methods yield the distribution of escaped neutrons with respect to the number of elastic collisions suffered. A computation of each type was made on the MANIAC for a particular shell, and an estimate of the escape fraction (0.70871) was obtained, based on a total sample of 215,000 source neutrons. The result is in good agreement with that (0.707) obtained by a modified transport theory. A comparison of the statistical and transport methods in the case of a thicker shell should be of greater interest, and a problem of this kind is being done. (auth)

5543

National Bureau of Standards
THE ALBEDO OF VARIOUS MATERIALS FOR 1 MEV PHOTONS. Evans Hayward and John H. Hubbell. Sept. 11, 1953. 26p. (NBS-2768)

The Monte Carlo method was used to determine the albedo of 1-Mev photons reflected from semi-infinite slabs of H_2O , Al, Cu, Sn, and Pb at various angles of incidence. The case histories of 67 photons were followed. For normal incidence the number varies from 33% for H_2O to 0.5% for Pb, and the energy albedo from 5% for H_2O to 0.1% for Pb. (auth)

5544

Radiation Lab., Univ. of Calif., Berkeley
PASSAGE OF ELECTRONS THROUGH MATTER. Edward Vaughan. Sept. 9, 1953. 12p. (UCRL-2338)

Energy-loss mechanisms for electrons are reviewed for rapid reference. Bremsstrahlung and ionization losses are emphasized, and range-energy considerations are discussed for several materials. (K.S.)

5545

SCATTERING OF X RAYS IN THE REGION OF K AND L EDGES OF HEAVY ATOMS. H. Eisenlohr and G. L. Müller. *Z. Naturforsch.* **a8**, 429-32(1953) July. (In German)

X-ray scattering on heavy atoms, calculated on the basis of wave-mechanical scattering theory for a closed spectral range of very short-wave radiation, inclusive of K and L adsorption edges, is discussed using two examples, Te

($Z = 52$) and W ($Z = 74$), and is compared with measured values. As a result of the investigation, scattering curves showing systematic deviations compared with prior calculations have been obtained. (tr-auth)

5546

ABSORPTION COEFFICIENTS OF THE β ENERGIES OF RADIOACTIVE ISOTOPES FOR AIR-EQUIVALENT SUBSTANCES. Kurt Sommermeyer and Karl Heinz Waechter. *Z. angew. Phys.* **5**, 242-8(1953) July. (In German)

Methods for measuring the absorption of β particles from point sources in air or air-equivalent substances are discussed, together with details of the process of β -particle absorption. Measurements of the absorption coefficient for S^{35} β particles are reported and are compared with those for P^{32} and I^{131} and for electrons of 2 Mev and greater energy. (G.Y.)

5547

DETERMINATION OF THE NEUTRON-PROTON CAPTURE CROSS SECTION. G. von Dardel and A. W. Waltner. *Phys. Rev.* **91**, 1284-5(1953) Sept. 1.

The period of exponential decay of neutrons in water was found to be 212 ± 3 sec, corresponding to a neutron-proton capture cross section of 0.321 ± 0.005 b for neutrons of 2200 m/sec velocity. Similarly, the absorption cross section of B was evaluated as 708 ± 12 b. (K. S.)

5548

THERMALIZATION OF POSITRONS IN METALS. R. L. Garwin. *Phys. Rev.* **91**, 1571-2(1953) Sept. 15.

In Bell and Graham's investigation (NSA 7-3950) of positron annihilation in solids, in which the lifetime of positrons in metals was found to be $1.5 \pm 0.3 \times 10^{-10}$ sec, the thermalization time 3×10^{-10} sec for positrons in metals calculated by DeBenedetti et al. (NSA 4-2094) is quoted, and the positrons are assumed to decay before thermalization. In the present note, it is pointed out that the thermalization time is actually $\sim 10^{-14}$ sec and that the calculations of the latter refer to monatomic insulators rather than to metals. The results of Bell and Graham are explained as immediate thermalization followed by capture (accelerated by the Auger effect involving the conduction electrons) to form positronium. Exchange collisions with electrons on the Fermi surface convert any triplet state to singlet, and so the decay is very rapid. The results with nonmetals indicate that some positrons are preserved either free or as triplet positronium, decaying probably not by conversion to singlet (in an insulator), but by annihilation with an electron of appropriate spin from a neighboring molecule. (G. Y.)

5549

GAMMA RAYS FROM INTERACTION OF 14-MEV NEUTRONS WITH VARIOUS MATERIALS. V. E. Scherrer, R. B. Theus, and W. R. Faust. *Phys. Rev.* **91**, 1476-8 (1953) Sept. 15.

Experiments have been performed to observe the pulse-height distribution produced in a single crystal spectrometer by γ radiation arising from bombardment of various materials with 14-Mev neutrons. Various γ -ray lines have been identified and estimates made of the total cross section for γ -ray production. (auth)

5550

RANGE-ENERGY RELATIONS OF 10- TO 250-KEV PROTONS AND HELIUM IONS IN VARIOUS GASES. Charles J. Cook, Emerson Jones, Jr., and Theodore Jorgensen, Jr. *Phys. Rev.* **91**, 1417-22(1953) Sept. 15.

An analyzed beam of ions was brought through a differential pumping system into a low-pressure gas stopping cell, where the data necessary to plot a Bragg curve were obtained with the aid of a double-grid ionization chamber of variable transverse radius. It was found that the resulting ionization extrapolated ranges may be uniquely

determined only if the ionization chamber radius is greater than the transverse radius of the ionization envelope of the beam in the stopping gas. The ionization extrapolated range-energy relations for slow protons and α particles were determined in various gases. These data are also expressed in terms of an empirical relation. The observed range-energy relations are compared with previous data where they exist. (auth)

6651

THE SCATTERING OF PARTICLES FROM PART OF THE NUCLEUS. E. Clementel and A. Coen, Nuovo cimento (9) 10, 988-90(1953) July 1. (In Italian)

The scattering of a particle emitted from the nucleus is analyzed. The Jackson-Blatt equation (Rev. Modern Phys. 22, 77(1950)) and the Placzek-Bethe equation (Phys. Rev. 57, 1075(1940)) are used to derive general equations for the scattering cross section at all energies and angular distributions. (J.S.R.)

6652

ELASTIC SCATTERING OF 118-MEV NEGATIVE PIONS BY HYDROGEN. Jay Orear, Phys. Rev. 92, 156-60(1953) Oct. 1.

Standard Ilford G5 plates were exposed in the 122-Mev external negative pion beam of the Chicago cyclotron. Scatterings of the pions by the H_2 in the emulsion were observed by scanning for recoil protons and examining the proton beginnings for an incoming and a scattered pion. Energy-momentum conservation permits separation of similar-looking nonhydrogen events from the pion-proton scatterings. Both 400- and 600- μ plates exposed to about 10^6 mesons/cm² were area scanned under 830 $\times$ magnification. A scanning-efficiency test composed of the events most difficult to see gave a lower limit of 90% for scanning efficiency. An average pion energy of (118 ± 2) Mev was determined from 23 events where the recoil proton stops in the emulsion. A total cross section for nonexchange scattering of (9.6 ± 2.0) mb was obtained based on 59 events. The differential cross section obtained can be fitted with the formula $d\sigma/d\omega = (0.49 \pm 0.15) + (0.16 \pm 0.21) \cos\chi + (0.85 \pm 0.45) \cos^2\chi$ mb per steradian. χ is the scattering angle in the center-of-mass system. This is consistent in shape and magnitude with the results of the Chicago scintillation-counter experiments. (auth)

6653

SCATTERING OF NEGATIVE PIONS BY HYDROGEN. E. Fermi, M. Glicksman, R. Martin, and D. Nagle, Phys. Rev. 92, 161-3(1953) Oct. 1.

The scattering of negative pions by liquid H_2 has been studied with the 450-Mev synchrocyclotron, using the pion beams of energy 169, 194, and 210 Mev. Angular distributions for ordinary scattering and for photon production are presented for each of the three primary energies. The differential cross sections for ordinary scattering and for charge-exchange scattering are computed for the center-of-mass system. The charge-exchange cross sections when plotted as a function of the energy appear to go through a maximum at about 180 Mev. On the other hand, the ordinary scattering cross sections appear to increase steadily with the energy. The charge-exchange cross sections, which at lower energies are predominantly backward, become rapidly forward as the energy increases and are strongly forward at the highest energy. (auth)

6654

PROTON-PROTON SCATTERING FOR A NUCLEON ISOBAR MODEL. F. T. Solmitz, Phys. Rev. 92, 164-72(1953) Oct. 1. (cf. NSA 7-3250).

High-energy p-p scattering is calculated for a static interaction which includes coupling to excited nucleon states. The spin and isotopic-spin dependence is taken

from the strong-coupling approximation of the charge-symmetric pseudoscalar meson theory; for the space dependence the Yukawa potential is used. The parameters of the interaction are chosen to fit the low-energy p-p scattering data. The calculated high-energy scattering cross section is strongly anisotropic and thus in sharp conflict with the experimental results. (auth)

6655

SCATTERING OF MESONS BY COMPLEX NUCLEI. W. W. Wada, Phys. Rev. 92, 152-5(1953) Oct. 1.

The result of the previous calculation (Phys. Rev. 88, 1032 (1952)) on the scattering of mesons by a single nucleon has been extended to the case of multiple scattering by nucleons in nuclear matter. Methods familiar in the dispersion theory in physical optics are used, and the index of refraction of the meson wave has been formally calculated. The absorption and diffraction scattering cross sections are computed, and relation with the results of the recent experimental observation is discussed. (auth)

6656

ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED FROM ALUMINUM, IRON, AND LEAD. W. D. Whitehead and S. C. Snowdon, Phys. Rev. 92, 114-19(1953) Oct. 1.

The differential cross sections for the scattering of 3.7-Mev neutrons from Al, Fe, and Pb have been measured in a ring geometry with a molded lucite-ZnS button as a detector. The measurements were taken over an angular range of 127° between 13 and 140° with an angular resolution better than $\pm 10^\circ$. Effects due to higher-order scattering in the scatterer were removed by extrapolation. (auth)

6657

AN APPROXIMATE WAVE-MECHANICAL DESCRIPTION OF DEUTERON STRIPPING. F. L. Friedman and W. Tobocman, Phys. Rev. 92, 93-100(1953) Oct. 1.

An approximate wave function describing the deuteron stripping process is set up in a fashion similar to that introduced by S. T. Butler. This wave function is made to fit boundary conditions at the surface of the nucleus for the stripped-off particle. Thus the parameters characterizing the nucleus that enter this description are similar to those familiar from the theory of single-particle nuclear reactions. The cross section for the stripping process is calculated from the wave function by a method that gives the cross section for stripping by virtual levels as well as that for stripping by bound levels. Some discussion is devoted to the Coulomb effect. (auth)

RADIATION EFFECTS

6658

Purdue Research Foundation
PRODUCTION OF LATTICE DEFECTS IN GERMANIUM BY ELECTRON BOMBARDMENT. Everett Earl Klontz, June 1952. 84p. (AECU-2664)

High-energy electrons have been used to produce two types of effects in N-type Ge. Intense ionization effects having lifetimes of about 10 μ sec have been found from observing conductivity changes during bombardment with 300-kv pulsed electrons from the Purdue Van de Graaff. Single crystals exposed to electrons of over 0.6 Mev from various Van de Graaff generators exhibit permanent changes due to lattice defects produced. Experimental procedures established the threshold at 0.63 Mev, corresponding to a minimum recoil energy (Wigner energy) of 30 ev for the Ge atoms. Following a procedure outlined by Lark-Horovitz, preliminary results were obtained indicating changes in Ge from N-type to P-type. Probing of the samples thus indicated similar effects for electron bombardment as for irradiation by heavy particles. More quantitative experiments in which

the changes in conductivity as a function of bombardment were observed can be used to determine the number of carriers removed from the conduction band. For energies near the threshold at bombarding temperature 77°K, only about two carriers in the sample are effectively removed for 10^4 electrons incident on the sample. At higher energies, the cross section for the process is much larger and indicates removal of up to one carrier in the irradiated volume for each 10^4 electrons incident at 1.8 Mev. The degree of damage produced by bombardment is a function of the energy, flux, and temperature of bombardment. Conductivity-flux curves for several bombardment energies and temperatures have been obtained. Heat treating the samples heals out bombardment-produced defects. The extent of healing depends on the temperature to which the sample is heated. Restoration of the original resistivity can be attained by heat treatment at 450°C for 24 hr, again in agreement with the results after quenching and nucleon bombardment. (auth)

- 6659 Washington Univ., St. Louis
RADIOACTIVE CHARGING THROUGH SOLID DIELECTRICS. Paul Y. H. Feng and J. W. Kennedy. [1953] 3p. (AECU-2685)

The induced potential developed on an insulated radioactive source, separated from ground by various dielectrics, is tabulated. Beta radiation from a 60-mc source of $\text{Sr}^{90}\text{-Y}^{90}$ was tested on teflon and polystyrene dielectrics, and the effective β current and dielectric resistance are recorded for several thicknesses of each material. (K.S.)

- 6660 Illinois Univ.
PROGRESS REPORT NO. 4 [ON RADIATION DAMAGE AND RECOVERY IN Cu, Ag, Au, Ni, AND Ta]. J. S. Koehler. Aug. 1, 1953. 8p. (COO-197; Progress Report 4)

The energy released when an irradiated Cu specimen is warmed from the temperature of bombardment, about -150°C, to room temperature was measured. (J.E.D.)

- 6661 RADIOACTIVE CHARGING EFFECTS WITH A DIELECTRIC MEDIUM. P. Rappaport and E. G. Linder. *J. Appl. Phys.* 24, 1110-14(1953) Sept.

A process is described in which radioactive radiation traverses a solid dielectric medium to charge a collector electrode. This process offers a simple method of studying effects of radiation on matter such as bombardment-induced conductivity, secondary emission, charge soakage, and radiation absorption. Typical data are given. Possible application of this process for the construction of a current or voltage source for use in electronic devices is discussed. (auth)

- 6662 FLUORESCENCE OF ORGANIC SUBSTANCES ON EXCITATION WITH FAST ELECTRONS AND γ RADIATION WITH SPECIAL CONSIDERATION OF THE CONSTITUTIONAL SPECIFICITY. Lieselott Herforth and Dietrich Rosahl. *Ann. Physik* 8, 340-7(1953). (In German)

In order to clarify the question of the structural specificity of the light yield in excitation with fast electrons and hard (Ra) γ radiation, fluorescence yield measurements were carried out on 1,3,5-triphenylpyrazoline and several of its halogen-substituted derivatives, on dihydrocollidine-dicarboxylic acid ethyl ester, and for comparison, on naphthalene, anthracene, and stilbene. Relative energy and quantum yields are calculated and compared with ultraviolet quantum yields, and the suitability of the substances as phosphors for scintillation counters is examined. Relations indicated by the measurements between structure and yield are discussed. (tr-auth)

RADIOACTIVITY

6663

Laboratory for Nuclear Science, Mass. Inst. of Tech.
 β -DECAY THEORY FOR CHEMISTS. Donald R. Wiles. [1953] 14p. (NYO-3594)

This report is essentially a review of the basic aspects of β -decay theory and is intended to be a tool for the nuclear chemist in computing mean lives, log ft values, etc. Calculations of transition probabilities and branching ratios for Zn^{69} are given as examples. A brief bibliography is presented. (L.M.T.)

6664

LOWER LIMIT FOR THE LIFETIME OF THE 665-KEV EXCITED STATE OF Mo^{97} . F. R. Metzger and W. B. Todd. *Phys. Rev.* 91, 1286-7(1953) Sept. 1.

The lower limit for the lifetime of the 665-keV γ activity from Mo^{97} is found to be 1.5×10^{-12} sec, and the nuclear level width $\Gamma \leq 5 \times 10^{-4}$ ev. (K.S.)

6665

GAMMA RADIATION EMITTED BY ORIENTED NUCLEI; THE INFLUENCE OF PRECEDING RADIATIONS; THE EVALUATION OF EXPERIMENTAL DATA. J. A. M. Cox and H. A. Tolhoek. *Physica* 19, 673-82(1953) Aug. (In English)

The angular distribution and polarization of γ radiation emitted by oriented nuclei was expressed earlier (NSA 7-3201) with the aid of parameters f_k . These parameters characterize the state of orientation of the nuclei from which the radiation is emitted. Here explicit formulas are derived for the change of the parameters f_k if the γ radiation under consideration is preceded by a β or a γ transition. A discussion is given of the data of physical interest, which may be obtained by the analysis of experimental data on γ radiation from oriented nuclei: multipole character of γ transitions, nuclear spins and parities, nuclear magnetic moments, data on the Hamiltonian for the β interaction, and nuclear matrix elements for β decay. (auth)

6666

ANGULAR DISTRIBUTION OF RADIATION EMITTED BY ARBITRARY ENSEMBLES OF NUCLEI. J. A. M. Cox and S. R. de Groot. *Physica* 19, 683-8(1953) Aug. (In English)

An arbitrary ensemble is described by a density matrix ρ with arbitrary values of its matrix elements. An equivalent description is given by Fano's statistical tensors, which are used in this paper. A simple closed formula for the angular distribution of nuclear radiation from an arbitrary ensemble is derived. (auth)

6667

THE LINEAR COMBINATION IN β DECAY. D. C. Peaslee. *Phys. Rev.* 91, 1447-57(1953) Sept. 15.

Empirical evidence on the shapes of first- and second-forbidden spectra is surveyed to determine the linear combination of invariants in the β -decay interaction. Absence of $1/W$ terms in allowed-shape first-forbidden spectra excludes combinations SA and VT. Spectrum shapes for $\Delta I = 2$, no, transitions exclude VA and indicate that for negatron emission the relative algebraic sign of the terms is (S-T). These spectra also indicate the need for considerable correction of nuclear matrix element estimates because of the presence of pseudoscalar-coupled forces in the nucleus. Extrapolation of these empirical corrections to the case of Bi^{210} shows that the full linear combination should be $[S-T + (1/\delta)P]$, where δ is positive and of order unity. Arguments based on symmetry principles indicate that the correct interaction should in fact be $(S \pm T + P)$, where $\pm$ refers to $\beta^\pm$ emission. The effects of the difference in sign of the T term should in principle be observable. This law for β decay is compared with the decay of the μ meson, and it is found that if the linear combinations are the same,

the coupling constants also have identical absolute values. The mean coupling constant is $|f| = 1.44 \times 0.04 \times 10^{-49}$ erg cm³. The chief experimental doubt concerns the μ -meson spectrum, which is expected to go through zero at its end point if the β and μ interactions are identical. It appears possible to deduce the combination ($S - T + P$) uniquely from the postulates that the neutrino field is (1) unique; (2) massless; (3) part of a universal four-particle interaction. (auth)

5658

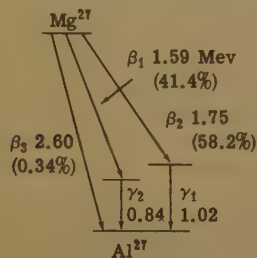
THE RADIOACTIVE DECAY OF TUNGSTEN 181. J. M. Cork, W. H. Nester, J. M. LeBlanc, and M. K. Brice. *Phys. Rev.* 92, 119-30(1953) Oct. 1.

W enriched in mass 180 was used. Neutron capture produces a strong activity in W¹⁸¹ with a half life of about 140 days. Scintillation-crystal and photographic-magnetic spectrometers were used, and two γ rays of energy 136.5 and 152.5 kev are found to occur. Neither of these had been previously observed, and conversely none of the previously reported γ energies are found to exist. The main decay of W¹⁸¹ takes place by K capture directly to the ground state of Ta¹⁸¹. Coincidence measurements are made with some evidence that the γ rays are in sequence. (auth)

6669

DECAY OF Mg²⁷. H. Daniel, L. Koester, and Th. Mayer-Kuckuk. *Z. Naturforsch.* a8, 447-8(1953) July. (In German)

The β decay of Mg²⁷, the half life of which was found to be 9.51 ± 0.03 min, was studied with Al absorbers, with an air-core spectrometer, and with a γ -ray scintillation detector. The following decay scheme was established. (G.Y.)



6670

EXCITED STATES OF K⁴⁰. W. W. Buechner, A. Sperduto, C. P. Browne, and C. K. Bockelman. *Phys. Rev.* 91, 1502-4 (1953) Sept. 15.

By use of a magnetic spectrograph in conjunction with an electrostatic generator, the region of excitation in K⁴⁰ has been studied up to 1 Mev with the K³⁹(d,p)K⁴⁰ reaction. Excited states in K⁴⁰ have been found at 0.032, 0.800, and 0.893 Mev, the Q value for the ground-state reaction being 5.576×0.010 Mev. (auth)

SPECTROSCOPY

6671

Spectroscopy Lab., Ill. Inst. of Tech. SUBSTITUTED METHANES. 19. C¹³ ISOTOPIC SHIFTS IN THE VIBRATIONAL SPECTRUM OF METHANOL; TECHNICAL REPORT [ON] MOLECULAR SPECTROSCOPY, MOLECULAR STRUCTURE AND THERMODYNAMICS. Richard B. Bernstein, James E. Lampert, and Forrest F. Cleveland. Submitted Aug. 14, 1953. 3p. (NP-4773; Technical Report 17)

A sample containing 9.3 at. % C¹³ was used in measuring several isotopic frequency shifts in the Raman (liquid) and infrared (vapor) spectra of methanol. From 6 Raman spectrograms of the C¹³-enriched sample, obtained under various conditions, lines due to C¹³H₃OH were identified and measured. A third line of low intensity, attributed to C¹³H₃OH, also was measured. From the infrared spectro-

grams, only one band due to C¹³H₃OH could be observed with certainty; this was the Q-branch of the band corresponding to the C¹³-O stretching vibration, which was superimposed on the P-branch of the corresponding band of C¹²H₃OH. (J.A.G.)

6672

Duke Univ.

QUARTERLY PROGRESS REPORT, FEBRUARY 1, 1953 [TO] MAY 1, 1953. MICROWAVE SPECTRUM AND MOLECULAR STRUCTURE OF TRICHLORO GERMANE Putcha Venkateswarlu, Richard C. Mockler, and Walter Gordy. MICROWAVE SPECTRA AND MOLECULAR STRUCTURES OF HSiCl₃, CH₃SiCl₂ AND (CH₃)₂SiCl. Richard C. Mockler, Jep H. Bailey, and Walter Gordy. THEORY OF THE ROTATIONAL SPECTRA OF ALLENE-TYPE MOLECULES. Masataka Mizushima. 67p. (NP-4823; Report 1)

Microwave Spectrum and Molecular Structure of Trichloro Germane. From measurements of the pure rotational transitions in trichloro germane, the rotational constants B₀ (in Mc/sec) for the various isotopic modifications of the molecule were found to be: 2172.75 for HGe⁷⁰Cl₃³⁵, 2169.26 for HGe⁷²Cl₃³⁵, 2165.84 for HGe⁷⁴Cl₃³⁵, 2063.74 for HGe⁷⁰Cl₃³⁷, 2060.43 for HGe⁷²Cl₃³⁷, and 2057.20 for HGe⁷⁴Cl₃³⁷. The calculated structure from the above data for the molecule in the ground state is: d_{GeH} = 1.55 ± 0.04 Å, d_{GeCl} = 2.1139 ± 0.0010 Å, and ∠ClGeCl = 108° 17' ± 12'. Rotational lines for the molecule when it is in the two excited GeCl₂ deformation vibrations are also measured and the corresponding molecular structures calculated. Microwave Spectra and Molecular Structures of HSiCl₃, CH₃SiCl₂ and (CH₃)₂SiCl. From measurements of pure rotational transitions in the microwave region the following molecular constants have been obtained. The B₀ values are in Mc/s, 2472.45 ± 0.04 for HSi²⁸Cl₃³⁵; 2346.07 ± 0.04 for HSi²⁸Cl₃³⁷; 1769.84 ± 0.03 for C¹²H₃Si²⁸Cl₃³⁵; 1699.79 ± 0.03 for C¹²H₃Si²⁸Cl₃³⁷; 2197.44 ± 0.04 for (C¹²H₃)₂Si²⁸Cl₃³⁵; and 2147.88 ± 0.03 for (C¹²H₃)₂Si²⁸Cl₃³⁷. With d_{SiH} = 1.47 Å (assumed) it is found for SiHCl₃ that d_{SiCl} = 2.021 and ∠ClSiCl = 109° 22'. With the CH₃ configuration assumed as in methane and ∠ClSiCl as in SiHCl₃, it is found for CH₃SiCl₂ that d_{SiC} = 1.896 Å and d_{SiCl} = 2.021 Å. With all bond angles assumed to be tetrahedral and the CH distance to be that in methane it is found for (CH₃)₂SiCl that d_{SiCl} = 1.87 Å and d_{SiCl} = 2.03 Å. Theory of the Rotational Spectra of Allene-Type Molecules. The possibility of observing the rotational spectra of allene-type molecules was suggested by the present author and Venkateswarlu. In this paper the feature of that spectra is discussed in some details. The effect of nuclear spin on the statistical weight of each rovibrational level, hyperfine structure, Zeeman effect and Stark effect are calculated. (auths)

6673

Baird Associates, Inc.

TECHNICAL REPORT COVERING THE PERIOD JANUARY 1, 1953 TO JULY 1, 1953. Robert O'B. Carpenter, Stanley J. Sage, and Norman Hapgood. 52p. (NP-4912)

The Fabry-Perot interferometer with mica cleavages as the spacer, as described in the last report, is completely investigated in this report. The properties of mica seem to render it impractical for the usage envisaged, namely, the variability from sample to sample in birefringence, the impossibility of cleaving to a prescribed thickness, and its absorption. An ADP birefringent polarization filter, a unique type of tunable filter, is described and analyzed completely in this report. It is found that it is suitable for only moderate-accuracy isotopic analysis. Part of its difficulty arises from the fine structure of H_α and D_α, and this effect

is analyzed. The other difficulties are the high tolerances required in flatness of plates and in temperature control. (For preceding period see NP-4250.) (auth)

6674

MOLECULAR BEAM INVESTIGATION OF ROTATIONAL TRANSITIONS. I. THE ROTATIONAL LEVELS OF KCl AND THEIR HYPERFINE STRUCTURE. Charles A. Lee, B. P. Fabricand, R. O. Carlson, and I. I. Rabi. *Phys. Rev.* **91**, 1395-403(1953) Sept. 15.

The molecular beam electrical resonance method, which has heretofore been confined to the study of transitions between the $m = 0$ and $m = \pm 1$ states of diatomic polar molecules in the state $J = 1$, has been extended to the study of rotational transitions from $J = 0$ to $J = 1$. The inhomogeneous electric fields together with a stop wire are so arranged that molecules in the state $J = 0$ are selectively refocused on the detector. A transition to the state $J = 1$, under the influence of the applied rf field, is observed by a reduction in beam intensity at the detector. The spectra obtained in this way yield more information than with the older method. The hyperfine structure of the state $J = 1$ of the molecules $K^{39}Cl^{35}$, $K^{39}Cl^{37}$, and $K^{41}Cl^{35}$ has been investigated at zero field for several vibrational states. The molecular constants obtained for these molecules are given. The structure of the $J = 1$ state was attributable to a nuclear quadrupole interaction for each nucleus. The variation of $(eqQ)_K$ and $(eqQ)_{Cl}$ with vibrational state are tabulated. The ratio of the quadrupole moments of the K isotopes is $Q_{K^{41}}/Q_{K^{39}} = 1.220 \pm 0.002$. From observation of line shifts in a weak electric field, the molecular dipole moment was determined in two vibrational states. For $v = 0$, $\mu = 10.48 \pm 0.05$ Debye, and for $v = 2$, $\mu = 10.69 \pm 0.05$ Debye. The ratio of the dipole moments is 1.020 ± 0.004 . The mass ratios of the Cl and K isotopes calculated from the molecular constants are $Cl^{35}/Cl^{37} = 0.9459803 \pm 0.0000015$ and $K^{39}/K^{41} = 0.9512189 \pm 0.0000015$. (auth)

6675

MOLECULAR BEAM INVESTIGATION OF ROTATIONAL TRANSITIONS. II. THE ROTATIONAL LEVELS OF KBr AND THEIR HYPERFINE STRUCTURE. B. P. Fabricand, R. O. Carlson, C. A. Lee, and I. I. Rabi. *Phys. Rev.* **91**, 1403-8(1953) Sept. 15.

The molecular beam electrical resonance method has been used to study the hyperfine structure of the first rotational state in $K^{39}Br^{79}$ and $K^{39}Br^{81}$. The hyperfine structure arises from the splitting of the $J = 1$ state into 10 levels by the quadrupole interactions of K and Br. Molecules in the $J = 0$ rotational state were refocused, and transitions to the $J = 1$ state were observed by a decrease in beam intensity at the surface ionization detector. From the structure of the line resulting from the transition $J = 0 \rightarrow J = 1$ in the three lowest vibrational states, the following results were obtained. The molecular constants are given. The quadrupole interactions and dipole moments in $K^{39}Br^{79}$ in the $v = 0, 1, 2$ vibrational states are tabulated. The quadrupole interactions in the $v = 0$ state of $K^{39}Br^{81}$ are $(eqQ)_K = -5.002 \pm 0.003$ and $(eqQ)_{Br} = 8.555 \pm 0.006$ Mc/sec. The mass ratio of the Br isotopes is $M_{Br^{79}}/M_{Br^{81}} = 0.9753088 \pm 0.0000020$. The ratio of the Br quadrupole moments is $Q_{Br^{79}}/Q_{Br^{81}} = 1.1973 \pm 0.0006$. (auth)

6676

NUCLEAR QUADRUPOLE RESONANCE OF BROMINE IN MOLECULAR SOLIDS. S. Kojima, K. Tsukada, S. Ogawa, and A. Shimauchi. *J. Chem. Phys.* **21**, 1415-16(1953) Aug.

Absorption lines due to nuclear electric quadrupole resonance of the isotopes Br^{79} and Br^{81} in some molecular solids have been observed by the method of super regenerative detection. The resonance frequency and intensity of measured lines are given. The ratio of the resonance

frequencies of Br^{79} and Br^{81} isotopes was determined as 1.1970 ± 0.0001 . Quadrupole coupling constants of Br^{79} and I^{127} in alkyl halides are given. (L.T.W.)

6677

PURE QUADRUPOLE SPECTRA: ALKYL BROMIDES AND IODIDES. Henry Zeldes and Ralph Livingston. *J. Chem. Phys.* **21**, 1418-19(1953) Aug.

Pure quadrupole spectrum measurements on solid alkyl chlorides have been extended to alkyl bromides and iodides. Preliminary data are presented, and similarity in quadrupole coupling trends is elucidated. (L.T.W.)

THEORETICAL PHYSICS

6678

PROPERTIES OF THE SALPETER-BETHE TWO-NUCLEON EQUATION. Jack S. Goldstein. *Phys. Rev.* **91**, 1516-24 (1953) Sept. 15.

The relativistic two-nucleon equation of Salpeter and Bethe is examined in the ladder approximation for large binding energy, with an invariant interaction function. The binding energy is considered an adjustable parameter, and the coupling constant, $g^2/4\pi$, is taken as the eigenvalue of the problem. As a starting point for this study, the special case of two equal masses and binding energy equal to the total mass is considered. It is found that in this case the equation may be simplified to a remarkable degree. For zero quantum mass, a one-dimensional integral equation in momentum space is obtained, and solved, in closed form. The solutions can also be displayed in closed form in configuration space. Solutions exist corresponding to this binding energy for all positive g^2 . Requiring normalizability on a space-like surface in configuration space eliminates solutions for sufficiently small g^2 , but a normalizable continuum remains. Arguments are presented to show that this continuum is not due to the choice of binding energy but is, in fact, characteristic of the invariant equation. It is shown that, by introducing a h - f cutoff into the particle propagators and then going to the limit of infinite cutoff, the remaining continuum is reduced to a single physically sensible solution. (auth)

6679

THE WAVE FUNCTION OF A RELATIVISTIC SYSTEM. F. J. Dyson. *Phys. Rev.* **91**, 1543-50(1953) Sept. 15.

Three methods of handling problems in relativistic quantum mechanics are discussed. One is the Tamm-Dancoff method, one is the Bethe-Salpeter method, and the third is a new method intermediate between the other two. The connections between the three methods are investigated. It is shown that the new method provides a kind of bridge between the 3- and 4-dimensional points of view. The new method is illustrated with applications to simple examples. (auth)

6680

A NEW FORM FOR THE STATISTICAL POSTULATE OF QUANTUM MECHANICS. Norbert Wiener and Armand Siegel. *Phys. Rev.* **91**, 1551-60(1953) Sept. 15.

A new type of representation of the wave function of quantum mechanics, and a new form of the statistical interpretation of the wave function, are presented. The variable in the new representation is a mapping of points of differential space, closely related to Hilbert space, but having an associated measure for suitably defined sets of points in it. In the new statistical interpretation, an eigenvalue of every observable defined in the system is associated with each point in differential space. This can be done in such a way that, for each observable, the measure (=probability) of the set of all differential-space points belonging to a given set of eigenvalues is equal to the quantum-mechanical probability, calculated in the usual way (Born statistical

postulate), that an experiment will yield an eigenvalue in this set. Thus we obtain an interpretation of quantum mechanics in terms of probability densities or probabilities instead of probability amplitudes. (auth)

6681

THEORY OF ANGULAR CORRELATION OF NUCLEAR RADIATIONS. L. C. Biedenharn and M. E. Rose. Revs. Mod. Phys. 27, 729-77(1953) July.

An attempt is made to synthesize the various theoretical developments with particular emphasis on the interpretation which must be given to the various possible formulations of the theory. At the same time a discussion is presented of the various special cases of angular correlation with which the experimentalist is apt to be confronted, and a reasonably complete set of numerical results is provided so that the present article, it is hoped, can be used as a "handbook" on angular correlation so far as the theory is concerned. A discussion of specific experimental results is not attempted inasmuch as this will be covered by Frauenfelder (to be published). However, it is pointed out that it is necessary to recognize the relation of the theory to the circumstances under which the observations may be carried out. (auth)

6682

DEFICIENCY OF THE PHENOMENOLOGICAL THEORY OF THE LAMB SHIFT. Frederick J. Belinfante. Phys. Rev. 91, 1285-6(1953) Sept. 1.

New data on the Lamb shift of He^+ indicate a need for modifying the previous phenomenological theory (Phys. Rev. 84, 949(1951)) excluding self-interactions. Requirements for the complete dependence of Lamb shift on atomic number show that at least such part of the self-interaction corresponding to the finite part of the self-energy leading to the Lamb shift must be included. (K.S.)

6683

INTERACTION BETWEEN CLASSICAL ELECTRON AND QUANTIZED ELECTROMAGNETIC FIELD. I. R. Senitzky. Phys. Rev. 91, 1309-11(1953) Sept. 15.

The equations of motion for a quantized electromagnetic field subject to the influence of a classical electron of arbitrarily prescribed velocity are solved by a simple method involving the corresponding difference equations. The solution yields some results which are contrary to those of an earlier theory. An expression for the transition probabilities between a high-energy state and neighboring states of the field inside a resonant cavity is obtained. (auth)

6684

NONLINEAR PSEUDOSCALAR MESON THEORY. F. Cap. Nuovo cimento (9) 10, 1347-8(1953) Sept. 1. (In German)

A nonlinear pseudoscalar meson theory which makes a distinction between a field and an excitation is proposed. (G.Y.)

6685

THE USE OF TENSOR OPERATORS IN NUCLEAR COLLISION PROBLEMS. Lincoln Wolfenstein. Phys. Rev. 92, 123-5(1953) Oct. 1.

The consequences of the invariance under rotations and reflections of the collision matrix are expressed as a relationship between the expectation values of initial-state and final-state irreducible tensor operators in spin-orbit space. This relationship is used to give a proof of the Eisner-Sachs theorem on the complexity of angular distributions of nuclear reactions and some extensions of this theorem. (auth)

6686

THE YANG-FELDMAN FORMALISM AND THE BOUND STATE. Wolhart Zimmermann. Z. Physik 135, No. 4, 473-82(1953). (In German)

The model of an independent electron in a temporary, constant, external field was investigated by means of the existence of a bound state effected by a modification of the Yang-Feldman formalism (NSA 5-6245). (J.S.R.)

6687

THE STRUCTURE OF LARGE SCALE FIELDS FROM CLASSIC MECHANICS AND QUANTUM MECHANICS. Gottfried Falk. Z. Physik 135, No. 4, 431-72(1953) (In German)

By means of an axiomatic intensification of Bohr's correspondence principle, it is shown that the structure of a large-scale field of non-relativistic quantum mechanics—inclusive of non-relativistic spin theory—can be obtained from the classical-mechanical large-scale field by means of a modification of an axiom. The application of a method from relativistic mechanics yields the relativistic quantum mechanics, which in its turn contains an indication of an elementary particle theory. The method can be expanded to a relativistic spin theory. (tr-auth)

6688

RECOIL CORRECTIONS IN STRONG COUPLING MESON THEORY. G. Wentzel. Phys. Rev. 92, 173-7(1953) Oct. 1.

For the one-nucleon problem in the neutral PS-PS theory, a strong-coupling method is developed which in the limiting case of a static nucleon reduces to the conventional PS-PV strong-coupling theory for mesons in p states, and to the scalar pair theory for mesons in s states. While retaining the nonrelativistic cut-off procedure, the method allows to correct the theory for nuclear recoils of nonrelativistic order. One of these correction terms gives rise to a d-phase shift in meson-nucleon scattering, besides the s- and p-phase shifts obtained already in the static approximation. Some comments on the charge-symmetric theory are added in the final discussion. (auth)

6689

MATRIX ELEMENTS FOR THE NUCLEAR PHOTOEFFECT. Leslie L. Foldy. Phys. Rev. 92, 178-88(1953) Oct. 1.

A phenomenological formulation of the interaction of nuclear systems with the transverse electromagnetic field is developed, and expressions for the nuclear-photoeffect matrix elements are obtained. The development is based on the differential charge conservation law and the hypothesis that the charge- and current-density operators for a nuclear system can be expressed in terms of nucleon variables only, even through virtual mesons may play a role in the interaction of the system with the electromagnetic field. The charge- and current-density operators are expressed as the sum of one-particle, two-particle, etc., terms in analogy with the phenomenological treatment of potential interactions between nucleons. The treatment is sufficiently general to include velocity dependence of interaction charges and currents but is essentially nonrelativistic. Methods of explicitly constructing the most general forms of the charge- and current-density operators are given, taking into account general invariance and symmetry conditions to which they are subject. A new feature found in the present treatment is the possible existence of interaction effects in the charge-density operator which imply that long-wavelength electric-dipole matrix elements can be affected by interactions between nucleons (contrary to recent statements in the literature). The effects of the principles of charge symmetry and charge independence on nuclear-electromagnetic interactions are discussed. The form in which the photoeffect matrix elements are presented is such as to allow computation of all multipoles in an already summed form. (auth)

PATENTS

CHEMISTRY

6690

PREPARATION OF CARRIER-FREE RADIOACTIVE PHOSPHORUS VALUES. W. E. Cohn (to U. S. Atomic Energy Commission). U. S. Patent 2,653,076, Sept. 22, 1953.

In this method for preparing a carrier-free radioactive P composition from neutron-irradiated S, the radioactive P is obtained in HNO_3 solution by mixing the molten irradiated S with hot concentrated HNO_3 , subsequently cooling to solidify the S, and then separating the solution from the solid. The P may be removed from the solution by carrying on an insoluble metal hydroxide such as Fe or La, the hydroxide being formed by addition of the desired metal salt, and basifying with NH_4OH . The metal-hydroxide precipitate carrying P after removal from the solution may be dissolved in HCl in the case of Fe, and the FeCl_3 extracted by treatment with isopropyl ether, leaving the radioactive P in the aqueous medium.

6691

FLUORINE CELL. R. D. Fowler and W. B. Burford, III (to U. S. Atomic Energy Commission). U. S. Patent 2,651,613, Sept. 8, 1953.

The patent relates to an electrolytic unit for the manufacture of F and more particularly to a high-temperature carbon-anode cell for producing F by the electrolysis of fused alkali metal hydrogen fluorides.

ENGINEERING

6692

ELECTROMAGNETIC CENTRIFUGAL PUMP. F. E. Crever (to U. S. Atomic Energy Commission). U. S. Patent 2,652,778, Sept. 22, 1953.

The pump, designed for electrically conductive fluids, comprises a partitionless chamber having side walls composed of insulating material and having an enlarged peripheral portion with side walls composed of conducting material and with an outlet suitably disposed therein, an inlet centrally disposed in the chamber with side walls composed of conducting material, a direct potential source between the peripheral portion and the inlet extending radially within the chamber, and means for creating a magnetic field perpendicular to the chamber.

6693

APPARATUS FOR MEASURING LIQUID LEVEL. K. H. Kline (to U. S. Atomic Energy Commission). U. S. Patent 2,651,940, Sept. 15, 1953.

The invention relates to a simple, reliable, and accurate apparatus employing no movable parts for measuring, indicating, and/or controlling the liquid level of a body of liquid disposed in an inaccessible location. The resonant circuit is partially immersed in the liquid, the level of which is to be measured, so that the liquid itself forms an electrical component of the circuit. A h-f signal of known frequency is generated and applied to a resonant circuit, and a discriminator circuit is connected thereto so as to produce an output signal that corresponds in magnitude to the difference between an applied h-f signal and the mean resonant frequency of the resonant circuit.

6694

AUTOMATIC TANK PUMP DOWN. R. R. Cyr (to U. S. Atomic Energy Commission). U. S. Patent 2,652,188, Sept. 15, 1953.

An electric-circuit control is provided for automatically associating mechanical and diffusion pumps in a predeter-

mined sequence to evacuate a tank or reservoir to high vacuum.

6695

ELECTROMAGNETIC FLUID PUMP. N. H. Godbold (to U. S. Atomic Energy Commission). U. S. Patent 2,655,107, Oct. 13, 1953.

The invention relates to electromagnetic fluid pumps in which an electrically conducting fluid is impelled along a channel by the force which results from the reaction between an electric current passing through the fluid and an impressed magnetic field. The device comprises a fluid duct, means for traversing the duct with a magnetic field, and means for impressing an electrical circuit across the length of the fluid in the magnetized duct between a first point traversed by the magnetic field and a second point on the fluid duct remote from the magnetic field.

MINERALOGY, METALLURGY, AND CERAMICS

6696

METHOD OF FORGING METALS. E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,653,494, Sept. 29, 1953.

The invention relates to a method of forming Be into various intricate shapes and the unit used for carrying out the process. The method consists in submitting a composite unit comprising a Be mass, a layer of an inert refractory oxide therearound, and a metal jacket enclosing the layer to a forging operation within a range of temperature from about 700°C to less than the melting temperature of the minimum melting eutectic of the Be and the metal jacket.

PHYSICS

6697

RADIOACTIVITY SURVEY APPARATUS. S. M. Zollers (to U. S. Atomic Energy Commission). U. S. Patent 2,619,601, Nov. 25, 1952.

The apparatus is suitable for measuring and indicating the relative radioactivity of an object in the presence of background radiation and finds particular application to a system for indicating the relative radioactive contamination of a person or subject after exposure to radioactive materials.

6698

METHOD AND APPARATUS FOR DETERMINING FREQUENCY. G. D. Paxon (to U. S. Atomic Energy Commission). U. S. Patent 2,647,998, Aug. 4, 1953.

The device, for determining frequency of a signal, comprises an electronic frequency-sensitive apparatus which develops an output pulse of voltage each time the signal voltage passes through a predetermined frequency interval.

6699

BRIDGE FOR RESISTANCE MEASUREMENT. R. J. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,649,571, Aug. 18, 1953.

An improvement in a method and means for measuring electrical impedances is particularly well adapted to the measurement of resistances of high orders of magnitude. The specific circuit utilized is of the ratio-arm bridge type.

6700

MASS SPECTROMETER BEAM REGULATOR. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,651,723, Sept. 8, 1953.

The mass-spectrometer beam regulator described is capable of maintaining a constant current to a beam collector where there is a large difference of potential between the collector and the beam-accelerating electrode.

The apparatus comprises a r-f oscillator, means for modulating the oscillator as a function of the collected beam current, and means controlled by the output of the oscillator for regulating the accelerating voltage applied to the beam.

6701

IONIZATION CHAMBER CIRCUIT. G. K. Froman, W. H. Hinch, and R. J. Watts (to U. S. Atomic Energy Commission). U. S. Patent 2,651,726, Sept. 8, 1953.

An improved direct-coupled d-c amplifier for measuring minute currents is particularly adapted and designed to give stable operation in measuring very small currents such as those developed in an ionization chamber and employs a circuit having for the electrometer tube a pentode-type acorn tube.

6702

APPARATUS FOR MEASURING RESISTANCE. H. R. Heath (to U. S. Atomic Energy Commission). U. S. Patent 2,651,751, Sept. 8, 1953.

The invention covers apparatus for the measurement of resistance of electrolyte materials requiring the observance of special precautions during the measuring operations. One example of usage of the invention is in the measuring of the variations in resistance of human blood in the study of blood coagulation. The apparatus comprises a resistor connected in series with an electrolyte the resistance of which is to be measured, a constant-voltage source connected across the serially connected electrolyte and resistor, said resistor having a resistance of 100 to 1500 times the resistance of the electrolyte, whereby the current through the electrolyte is maintained constant, and voltage-measuring means connected across the electrolyte to indicate the resistance thereof.

6703

TEMPERATURE MEASUREMENT. A. J. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,652,497, Sept. 15, 1953.

The invention relates to a method and apparatus for measuring and indicating very high temperatures under conditions where thermocouples and optical pyrometers may be of only limited effectiveness. The apparatus is used for measuring temperature in a field of neutron radiation and comprises a permeable envelope containing a gas characterized by its property of forming a radioactive gas upon capture of a neutron, means for collecting the radioactive gas that diffuses through the envelope, and means for measuring the rate of diffusion, including a radiation monitor for the gas.

6704

GAS DISCHARGE DEVICE. L. R. Landrey and A. Mazzei (to U. S. Atomic Energy Commission). U. S. Patent 2,652,510, Sept. 15, 1953.

The cold-cathode gas-filled electron discharge device, particularly adapted for voltage-regulator operation, comprises a hermetically sealed envelope containing an ionizable gas, an anode, and a cathode, said cathode having an effective area no greater than that of the glow which the tube must support at maximum rated current when the effective area of the cathode is restricted by covering areas of the cathode with a ceramic insulating material.

6705

PULSE GENERATOR. E. C. Wiegand (to U. S. Atomic Energy Commission). U. S. Patent 2,654,840, Oct. 6, 1953.

The electronic pulse generator described, which has a substantially instantaneous rise time and a hyperbolic decay time, consists of a sawtooth pulse generator of the gas-relaxation type. The sawtooth pulses are inverted in the usual manner, and the resulting positive sawtooth pulse is impressed on the grid of a thermionic tube adjusted to operate on the hyperbolic part of its characteristic. The

hyperbolic output pulses present on the anode of the thermionic tube are impressed on a cathode follower so that the critically biased thermionic tube is decoupled from the load, and the pulses of desired shape are available from a low-impedance source.

6706

VAPOR DETECTOR. C. S. Presenz (to U. S. Atomic Energy Commission). U. S. Patent 2,654,845, Oct. 6, 1953.

A portable device for detecting toxic concentrations of Hg vapor in the atmosphere provides a sensitive detecting unit, a faster resolving bridge and associated electric circuit, and a circuit for an ultraviolet lamp that includes an automatic restart system. The latter feature is extremely important in that the detector may be left unattended without fear that a momentary line failure will render the device inoperable.

6707

BEAM DEFLECTOR. D. T. Scalise (to U. S. Atomic Energy Commission). U. S. Patent 2,654,851, Oct. 6, 1953.

The beam deflector described is for particle accelerators of the cyclotron type wherein ions travelling in circular orbits are repeatedly accelerated, in consequence of which such orbits increase in radii and thereafter ions in a pre-selected orbit are withdrawn from the accelerator. The apparatus comprises a plurality of curved and spaced conductive bars disposed about an outer path of travel of the ionized particles and having connected thereto a high-voltage pulsing source of extremely short duration.

6708

SURVEY INSTRUMENT. R. H. Firminhac (to U. S. Atomic Energy Commission). U. S. Patent 2,656,476, Oct. 20, 1953.

The patent covers a radiation detection and survey instrument and more particularly an ionizing chamber adapted for detecting low-energy β particles and secondary electrons. It is especially well adapted for use with a pulse-type detecting system.

6709

SIGNAL DEVIATION WARNING SYSTEM. J. E. Tillman (to U. S. Atomic Energy Commission). U. S. Patent 2,565,527, Oct. 20, 1953.

The sensitive detection or protective system described is capable of giving an alarm or warning upon the entrance or intrusion of any body into a particular area of zone protected by the system. The system employs an electromagnetic field of such directional characteristics and extent as to encompass the particular area to be protected to detect movement within an area or the field may be positioned to act as a barrier across any given opening such as a gate or a doorway.

6710

PROCESS FOR THE PRODUCTION OF RADIOACTIVE SUBSTANCES. E. Fermi, E. Amaldi, F. Rasetti, E. Segrè, and B. Pontecorvo (to U. S. Atomic Energy Commission). U. S. Patent 2,206,634, July 2, 1940.

The process, for production of isotopes including transuranic elements by reaction of neutrons, employs means for generating neutrons having a high average energy, slowing down and scattering the neutrons by projecting them through a medium of an element of a class including H, He, Be, C, Si, and Pb, and then passing the neutrons into a mass of material containing an element capable of forming a radioactive isotope by neutron capture, including radioactive isotopes capable of emitting β rays.